Lowell Innovation Network Corridor (LINC) Impacts

LINC's Transformative Impact on UMass Lowell and the City of Lowell

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Lowell Innovation Network Corridor Impacts

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For their insights into the development of Lowell; past, present, and future.

Executive Summary

UMass Lowell's Lowell Innovation Network Corridor ("LINC") project represents a potentially transformational change for the university, the City of Lowell, and Northeastern Massachusetts. By constructing student housing, spaces for advanced innovation and leading-edge companies in tech, as well as small residential units designed for young professionals, LINC offers the potential to add to Lowell's urban fabric, enhancing both the city and the university. LINC will extend Lowell's downtown commercial activity and foster vibrant public spaces in which students and residents want to live and work. From an economic development perspective, LINC will cultivate the research and the commercialization of technologies and further contribute to the overall competitiveness of the Massachusetts economy. By introducing commercial spaces where students and others living in the region can intern or work, the new uses and activities resulting from LINC can also serve to increase the pipeline for skilled labor – crucial for supporting future business growth in Northeast Massachusetts and generating jobs.

Working with UMass Lowell, the UMass Donahue Institute has researched the wide-ranging benefits the LINC project will provide to UMass Lowell, the City of Lowell, and the greater Northeast Massachusetts economy. The types of impacts are arranged into three parts for this report, including:

- Urban Revitalization
- Student Attraction and Retention; and the
- Economic Ecosystem.

These three analyses are followed by an economic impact analysis (EIA) of LINC which includes an overall estimate of the project, including multiplier effects, on Massachusetts' jobs, output, and revenues.

Urban Revitalization

- Lowell's long history of innovation will be further propelled into the future by the Lowell Innovation Network Corridor project.
- The increase in research space from LINC paired with additional housing and commercial space will provide a clear path for growth for future startups, allowing them to scale-up in Lowell.
- Lowell's population is growing, and LINC will help support that growth through new housing and complements nearby efforts to increase residential densities to support further development and a diverse housing mix.
- The LINC project will create a positive loop between Lowell's commuter rail station, downtown, and the UMass Lowell campuses – essentially making key commercial and academic areas of Lowell larger and more dynamic.
- LINC complements and advances existing City of Lowell initiatives, such as the city's Sustainable 2025 plan including initiatives to make Lowell a more "vibrant and unique urban hub", as well as the city's Open Space and Recreation Plan which calls for improved infrastructure, including enhanced and safe pedestrian access to the Merrimack River and canals.

- The city is on an upwards economic trajectory and LINC will help carry that momentum forward into a new era of economic development and urban revitalization, including the downtown area and the Acre neighborhood.
- LINC shares similarities with other projects across the country where universities are working with cities to support their communities by promoting urban revitalization, innovation, and economic development opportunities.

Student Attraction and Retention

- Colleges and universities across the country are confronting demographic headwinds as the student-age population is projected to decline in coming years. LINC, through its urban enhancements, housing, innovation, and business activities will help UMass Lowell maintain and raise its competitiveness for prospective students, staff, and faculty.
- LINC will provide more opportunities for collaboration between the university, students, faculty, start-ups, and businesses, all the while raising the university's reputation and competitiveness.
- Additional educational resources unlock opportunities for students. LINC can provide the stability that students need to commit to enrollment by creating more co-ops and internships and by building a relationship with potential employers.
- LINC provides the opportunity to improve and add amenities that will foster an urban environment to promote social interaction while strengthening the sense of safety on campus.
- The economic and urban dynamism introduced by LINC will enhance early perceptions while adding to the appeal of experiences on campus for enrolled students, faculty, residents, and workers. Once prospective students physically set foot on the UMass Lowell campus, it increases their likelihood of enrollment.
- More housing in Lowell attracts residents, talent, and jobs. The new housing included as part of the LINC project can help address the Massachusetts housing shortage with the added bonus of being co-located with employers on the cutting edge of innovation. For UMass Lowell students and graduates, the relationship between housing and employers present at LINC will be a motivating factor for them to remain in the city to grow their careers.
- Through LINC, UMass Lowell is joining a number of other universities and colleges throughout the nation in making the connection between urban redevelopment and revitalization initiatives with enhancing innovation, the student experience, and growth in the community. Through case studies of Trinity College (Hartford), the University of Maryland (College Park), Pennsylvania State University (State College), Yale University (New Haven), and Drexel University (Philadelphia), this report demonstrates the outcomes of varied initiatives that link the betterment of the community to the strengthening of the university and the furthering of economic development.

Economic Ecosystem

- Proximity to Greater Boston's constellation of research institutions and innovation companies provides a pool of employers that are likely to be attracted to the mix of amenities and attributes offered by LINC and the City of Lowell. Concurrently, UMass Lowell is cultivating start-ups that will be employers of the future.

- Greater Lowell's strong advanced manufacturing sector, particularly in precision instruments, defense-related industries, and medical equipment, synergizes with a professional services sector that is heavily focused on R&D, engineering, and biotech, positioning the area to support the kinds of innovative companies UMass Lowell seeks to nourish and attract through LINC.
- Major LINC partners like Draper and Mass General Brigham were drawn by the region's talent pool and research capabilities, and these collaborations will further position Greater Lowell as a hub for innovation.
- With a strong and diverse pipeline of well-educated STEM students from UMass Lowell and other nearby colleges and universities, the region is well-suited to support workforce development and local job growth.
- UMass Lowell's existing STEM programs and incubators provide an initial roadmap for LINC to follow and bring to the next level, helping to retain and scale-up startups in the region, facilitating partnerships with local companies, and further strengthening the area's economic foundation.
- The creation of hundreds of new housing units geared towards professionals as part of LINC is expected to enhance Lowell's attractiveness to companies by allowing talent to live in proximity to their workplaces.
- As the LINC area develops, it is poised to attract highly skilled workers from industries such as biotech, robotics, and advanced manufacturing, further integrating with and augmenting Greater Lowell's existing strengths.
- Ultimately, the expansion of housing and professional opportunities by LINC will strengthen Greater Lowell's innovation ecosystem, which has been cultivated since the city's founding, helping retain talent in Massachusetts and reinforcing the state's leadership in high-tech industries.

Economic Impact Analysis (EIA)

- The Lowell Innovation Network Corridor project represents a transformative development for UMass Lowell and the City of Lowell that will generate a significant number of jobs related to construction, business activity taking place at LINC, and spending associated with the expansion of housing units.
- The economic activity of LINC encourages other businesses to cluster near the school and will enable them to grow and contribute to the Massachusetts economy. UMass Lowell acts as an anchor institution and promotes economic activity in other industries besides higher education, notably supporting innovation and business formation in the Massachusetts scientific and technical economy.
- The economic impact analysis (EIA) captures the "multiplier" effects of the project as LINC-related activities reverberate through the Massachusetts economy[1] leading to higher levels of jobs as well as economic output. The economic impacts of LINC shown in this study were

[1] Such as investments at LINC lead to business activity (e.g., with suppliers) and then wages associated with LINC, directly and indirectly, are spent on housing, entertainment, food, etc. and so on and so forth throughout the Massachusetts economy.

estimated through the application of the IMPLAN econometric model based on inputs provided by UMass Lowell.

- The economic impact analysis[2] conducted by the UMass Donahue Institute estimates the following impacts[3]:
  - An average of 2,000 net new annual jobs over the 2024-2033 period (equivalent to 20,000 worker years of employment)
  - A $3.7 billion estimated net increase in economic output over the ten-year 2024-2033 period, averaging approximately $370 million per year in economic activity.
  - Initially, construction-related impacts will provide the highest levels of economic activity for LINC. This will be followed by growing levels of business-related impacts as tenants begin occupying space in the project[4].
  - The IMPLAN econometric model demonstrated that the LINC project will generate substantial tax revenues at the local, state, and federal levels. Combined, local and state revenues will reach an annual peak during construction at approximately $29 million. Following the peak and led by business-related activities, annual revenues are expected to be at least $16.2 million per year going into the future.

[2] Note that the EIA was conducted prior to Draper's expansion announcement at LINC and the economic impacts with the inclusion of Draper are likely to be higher than those shown

[3] Note that the impacts do not include economic activities associated with increased numbers of visitors or business spin-offs associated with LINC undertakings

[4] Note that the business impacts are likely to be greater following the announcement that Draper will be an anchor LINC tenant with a large-scale presence

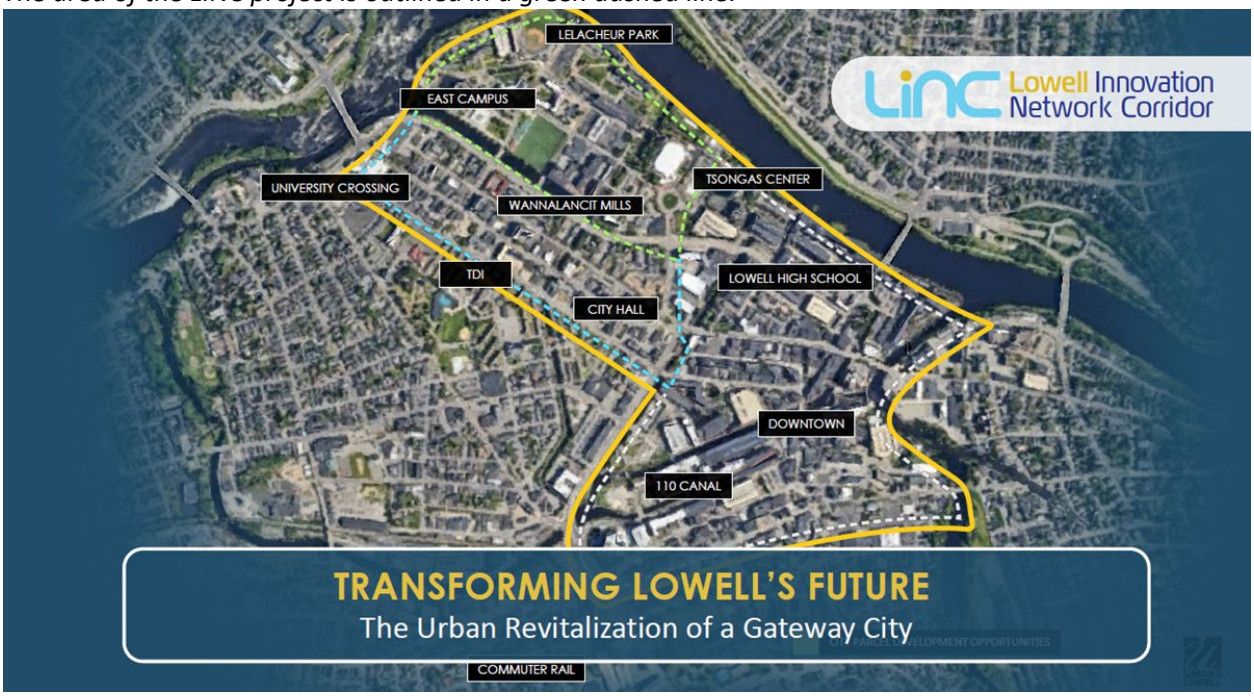
Urban Revitalization

UMass Lowell and the City of Lowell are in the early stages of undergoing a transformative investment called the Lowell Innovation Network Corridor (LINC). This public-private partnership is expected to produce over $3.7 billion in economic activity, $17 million in tax revenues and create 2,000 permanent jobs over the next decade. The plan is substantial, involving 1.2 million square feet of new real estate.

LINC incorporates large investments in research and development space, housing, commercial space, and substantial infrastructure investments to support these developments. The project has a committed anchor tenant in non-profit Draper Laboratory (Draper) of Cambridge, which is expanding its microelectronics division into Lowell, leasing space in the Wannalancit building with plans in the future to lease newly built research space developed as part of the LINC project.

Figure 1: LINC Project Map

The area of the LINC project is outlined in a green dashed line.



Wexford Science and Technology, one of the primary developers on the LINC project, has extensive experience with integrating research and development space into college campuses, housing and commercial venues. Wexford has created innovative projects around the country and in the northeast including in Baltimore, Philadelphia, Pittsburgh, and Providence. College campuses across the country are taking an increased interest in developments like LINC in their cities to support their communities and provide better opportunities for students.

Lowell is well positioned for this project for a variety of reasons. UMass Lowell has world-class science, technology, engineering, and mathematics (STEM) programs and facilities. Employers recognize this, with the campus being an important partner of many high-tech companies, both for innovation and for bringing in talented new workers. Investments in research space and partnering with additional STEM-

oriented employers through LINC will further enhance these qualities. The City of Lowell has tremendous cultural and physical assets, a strong urban fabric, and convenient commuting access, both by rail and roadway access, to and from the Greater Boston region. The city is making key investments in placemaking, in boosting its downtown, and in housing. The city has introduced a plan to address the MBTA community housing law, an opportunity for the city to invest in housing in and around the commuter rail station. These investments in various parts of the city will all complement and benefit from the LINC. Starting at the commuter rail station, a 30-minute walk north takes pedestrians through the Hamilton Canal Innovation district, through the Lowell Historic Park and Lowell's downtown before ending at the site of LINC. LINC will amplify and support these areas and adjacent parts of the city including the Acre neighborhood where LINC will be located. LINC will bring more residents, students, workers, and visitors to the area, creating a critical mass of density that will enhance Lowell.

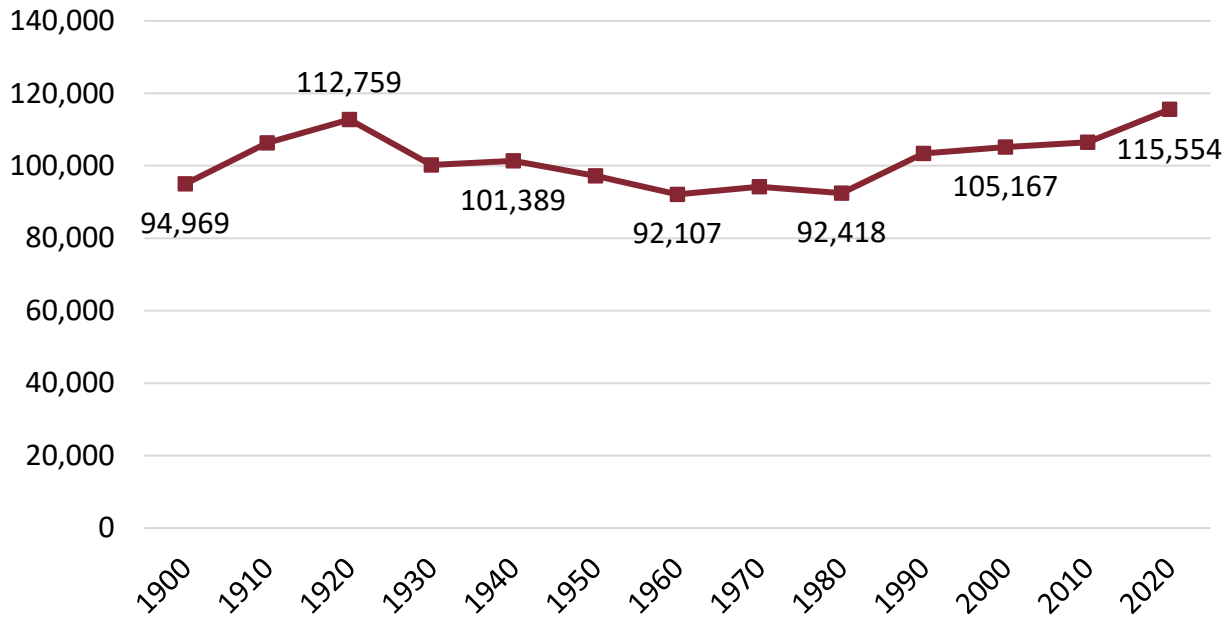
LINC is a critical piece for unlocking Lowell's economic potential. As UMass President Marty Meehan (a Lowell resident, former congressional representative, and the second chancellor of UMass Lowell) stated during the unveiling of LINC: "This will be the most significant commercial development on the banks of the Merrimack River since the mills." Lowell has been a center of innovation since its incorporation in 1826. From early steam engines, to textiles, to computers, Lowell has hosted tremendous advancements in science and technology and the city's educational institutions have grown with it. Since its founding near the turn of the century, originally as the Lowell Normal School, UMass Lowell has also developed extensive industry relations connecting diverse industries with research and talent. The depth of these relationships will allow the LINC project to be a durable investment in the city of Lowell. This new campus will continue Lowell's innovative tradition while delivering additional jobs and opportunities for Lowell residents and students.

Lowell Reinvention

Lowell was incorporated as a town in the early 19th century and grew rapidly. The Merrimack River made the region desirable for habitation and the steep drop in the river made it a prime source of waterpower. Waterpower enabled Lowell to become one of the first textile manufacturing hubs in North America. Lowell would also pioneer the construction of the New England region's first steam locomotives. The city would remain a manufacturing center from its founding through the first half of the 20th century. Richard Howe, Registrar of Deeds for Middlesex County, and author of several books on the city refers to Lowell as the: "Silicon Valley of nineteenth century America" as businesses and workers in the city rapidly adapted to changing technological and economic times.[5]

[5] For more details on the history of Lowell before the 1970s, see **Appendix A: Lowell's Economic Development**

Figure 2: Historical Population of Lowell



Source: U.S. Decennial Census

In the late 1970's three major changes occurred. The first was the establishment of the University of Lowell (now the University of Massachusetts Lowell) which emerged from the union of Lowell Technological Institute (formerly the Lowell Textile School, founded in 1895) and Lowell State College (formerly the Lowell Normal School founded in 1894) in 1975[6]. Then in 1978 the Lowell National Historical Park was created. The park supported the process of preserving and protecting Lowell's history, culture, and architecture. The creation of the park brought attention to the city in the form of more visitors and helped preserve the city's character.

The third event was the decision of Wang Laboratories to establish the company's headquarters in the city. Wang brought a cutting-edge computer business to the city, a major competitor in early computing. Wang became the largest employer in the city and grew to be one of the largest suppliers of word processors in the world. Wang and other makers of minicomputers like Digital Equipment, Data General, and Prime Computer contributed to boom economic times in Massachusetts in the 1980s, the "Massachusetts Miracle"[7]. Once again, Lowell was at the forefront of technology. The Silicon Valley of the East had sprung back to life.

Unfortunately, this boom did not last, Wang Labs's efforts in standalone word processing did not catch on as was hoped and by 1992 the company had gone bankrupt. This coincided with a recession in the late 80s and early 90s across much of the Northeast and troubles at other Massachusetts based computer companies such as Digital Equipment Corporation. Today, there are two prominent reminders of Wang Labs. Its former Headquarters, the immense office complex now known as Crosspoint Towers and Middlesex Community Colleges Cowan Center at Kearney Square, Wang's former training center.

[6] For more details on the institutions that became UMass Lowell see the campus website: https://www.uml.edu/about/mission.aspx
[7] A history of Wang Lab's founder, An Wang: https://history.computer.org/pioneers/wang.html

In these buildings is a vision of Lowell's continued economic recovery. After auction, Wang Lab's former headquarters was sold for a fraction of its construction cost and was renamed Crosspoint Towers. Fortunately, with support from the city, Verizon became a new tenant, and since then the building has been able to maintain a high level of occupancy. In 2016, Ultimate Kronos Group (UKG), a provider of business software and services, moved into the building. UKG is thought to be Lowell's largest private employer with over 1,000 workers[8]. Even more recently, IBM, a former rival to Wang Labs, has leased office space in the building. The Wang training center has become the center of the Middlesex Community College's city campus, now known as the Middlesex Community College Cowan Center, and for the past 35 years has been part of the continued growth in the city's education sector. UMass Lowell also repurposed a piece of Lowell history by transforming St. Joseph's hospital into University Crossing, which now sits at the center of the UMass Lowell campus.

Richard Howe sees these buildings as an example of the city's ability to take what it has and repurpose it for the moment. There is innovation in the DNA of the community in Lowell and an unwillingness to take no for an answer when challenges appear.

New Opportunities in Lowell

In 2007, Lowell was among the original eleven cities in the Commonwealth designated as a Gateway City. The number of gateways cities has since grown to 25 around the Commonwealth. This designation indicates many things – it is a city that has undergone continued economic hardship in the wake of deindustrialization, as well as a community with tremendous, underutilized assets. As social and economic conditions change in the city, those assets can be leveraged to do transformational things like LINC. Lowell has institutions it can draw upon for development such as UMass Lowell. The city has a strong urban core that most suburban communities can only hope to recreate.

Lowell has had a strong immigrant community going back to the mill workers of the 1800s. The census estimates that 27 percent of the population in the city is foreign born. The city has a large Cambodian population, estimated to be around one fifth of the city's population according to the 2010 Census[9]. These strengths give Lowell the ability to make the most of new developments and changing economic conditions.

Lowell today is using ingenuity to adapt to modern industries and challenges. Lowell's development continues to exhibit adaptability and inventiveness. Those strengths allowed the area to become a global leader in manufacturing, to overcome economic headwinds to become a center of computing, only to again reinvent itself into a center of education. As City Manager Tom Golden put it, the city of Lowell has undergone transformation but there remains a core commonality to its residents:

> *So, the names may have changed, but the people remain the same… hard working, dedicated, loyal to their family. An educated workforce, people who are energetic, ready to learn, and serve the city in the way that they best see.*

[8] According to the Massachusetts Department of Economic Research and Data Axle: https://lmi.dua.eol.mass.gov/lmi/LargestEmployersArea/LEAResult?A=05&GA=000241

[9] Lowell and the Growth of a Cambodian Community, https://libguides.uml.edu/c.php?g=1315041&p=9669216

The LINC project is building on the history and experiences of its residents. LINC will allow Lowell to leverage the advanced STEM education of UMass Lowell and the Commonwealth's growing tech sector to create jobs, tax revenue and bring new opportunities to the city. It will do so while preserving the unique character of the city and by leveraging existing strengths.

Lowell Development Today

The City of Lowell and the UMass Lowell Campus have worked together to invest in the future of the city. The city has made investments in placemaking, infrastructure, and housing throughout the city. The campus has continued to improve its academic programming to suit the needs of its student body and the needs of future employers. LINC will provide a fusion of these efforts. The benefits of this work are concentrated in Lowell and in the Commonwealth. To better understand what the campus and city will be able to do with LINC, it is important to understand what they currently are working on.

The Campus

Research

NORTH CAMPUS

UMass Lowell is a leader in STEM education. The University's strengths in this area can be seen in the heavy investments by the campus in research space across the city. Opened in 2012, the Saab Emerging Technologies and Innovation Center (ETIC) at UMass Lowell is an advanced research facility containing extensive lab space. A major part of Saab ETIC is dedicated to nanofabrication, allowing users to prototype microscopic machines. Users include students and the private market. After receiving training, companies and individuals can pay to use the labs with supervision from trained staff. This is a tremendous asset for local startups who can begin their work using UMass Lowell's equipment. Startups can develop their ideas without having to invest a huge amount of capital in new equipment such as million-dollar electron microscopes which UMass Lowell possesses and maintains. UMass Lowell is providing a service to the Commonwealth's economy not only by educating the next generation of creators, but also by providing the tools and materials to startups.

The Saab ETIC is also home to the Raytheon UMass Lowell Research Institute (RURI). This lab specializes in printed electronics and nanotechnology. This includes projects such as printing electronic devices on bendable services, allowing for the creation of flexible, self-heating clothing, particularly of use to the Department of Defense. The lab partners with Raytheon, helping them answer research questions at small scale that can then be scaled up in the future. This provides students with a hands-on learning experience. Raytheon acts like an anchor tenant, like you might find with a major department store in a commercial center, their presence encourages other companies to join in such as Collins Aerospace which has worked on fuselage technology with UMass Lowell, or Flexcon a company that specializes in advanced materials. These companies hire UMass Lowell students at a high rate because of their direct experience and related advanced skills. The Lowell Innovation Network Corridor will provide more opportunities for these sorts of collaborations between the University and the private sector, while improving the ability for people working in these places to live, work and play in Lowell.

WANNALANCIT

Another example of active research space on campus can be found in Wannalancit, a former mill building which contains leasable lab and office space for private startups to site themselves. This includes dedicated space for startups who are part of the Massachusetts Medical Device Development

Center (M2D2), an incubator providing wet and dry labs, office and meeting space, and state-of-the-art equipment for medical device, medtech, and biotech startup companies to grow. M2D2 is a joint initiative of UMass Lowell and UMass Medical School.

110 CANAL

UMass Lowell-empowered research is occurring in Lowell's Hamilton Canal Innovation District which is home to 110 Canal. 110 Canal contains the UMass Lowell Innovation Hub which provides coworking space and access to lab space. The innovation hub can also connect startups to other labs across campus and at 110 Canal. The building is also home to additional labs and office space for M2D2 startups, the Fabric Discovery Center, the Heroes Center, and the New England Robotics Validation and Experimentation (NERVE) Center. The Fabric Discovery Center specializes in advanced fabrics and the work performed there echoes that of the textile mills that once dominated Lowell's economy. They are developing and working with materials such as thread with the capabilities of a solar panel and collaborating with other researchers to produce biodegradable alternatives to plastics found in clothing, among other projects. New startups have spun out of the Fabric Discovery Center including Z-Polymers Incorporated which produces high-strength 3D printing filament. The center's work can have a very direct impact on the Commonwealth. During the COVID-19 pandemic, the center engaged in extensive testing of mask technology, including acquiring specialized equipment to test the efficacy of different mask materials and styles. That work allowed them to invent and get approval of new forms of personal protective equipment.[10] In keeping with Lowell's history of inventiveness, all the campus's research efforts demonstrate an ability to be flexible and adapt to changing needs. With LINC, the campus will have more resources to address pressing research needs including those with immediate application to aid the Commonwealth.

The research activities at 110 Canal also reflect the ability of the campus to attract attention both from the public and private sectors. The labs and offices there contribute to the Harnessing Emerging Research Opportunities to Empower Soldiers (HEROES) program, a partnership between UMass Lowell and the U.S. Army's Combat Capabilities Development Command. Extensive work related to the HEROES program is being performed at the NERVE Center at UMass Lowell. NERVE is exploring the performance of robotics, humans and how they can better work together.

LINC will provide room for these initiatives to grow. Currently, companies that start out at 110 Canal, for example those that work with M2D2, can expand into existing space in Wannalancit and its future expansion. Additional research space paired with additional housing and commercial space will provide a clear path for growth for future startups. Researchers in these spaces can collaborate closely with Campus faculty in an off-campus environment. The LINC project will provide more room for that activity. There is an opportunity for considerable cross-pollination between the Hamilton Canal Innovation District and LINC. The Hamilton Canal Innovation District is a prominent place where the city, campus and private industry have begun to synchronize their approaches to development.

Saab ETIC, Wannalancit, 110 Canal and other centers and institutes on campus all incorporate partnerships that allow businesses to lease space and work with faculty and students. These partnerships enhance the research done on campus and provide new opportunities for faculty, staff, students, and businesses.

[10] UMass Lowell article on the PPE testing initiative: https://www.uml.edu/engineering/research/engineering-solutions/fdc-ppe.aspx

Collaboration

The city and the campus are working together to move Lowell forward. City Manager Tom Golden spoke positively about the campus and city relationship: "…the way that the city of Lowell goes is the way that the University will go, and I truly believe that the way the University goes is the way that the city of Lowell goes…". Manager Golden emphasized that partnerships are vital for growth and that the city's partnership with the University had resulted in more resources for the city. Much of this collaboration relates to development. The city has worked with the state to rebuild bridges and widen sidewalks as part of the Lowell Canal Bridges Project[11]. For example, in 2022, the Northern Canal bridge which crosses into East Campus along Pawtucket Street was renovated allowing bus traffic to flow across it. The Lowell Canal Bridges Project was funded by a $13.4 million Transportation Investment Generating Economic Recovery (TIGER) grant from the U.S. Dept of Transportation secured by the city in partnership with the University. UMass Lowell also contributed $3 million to the project. These infrastructure improvements will be vital for the development of LINC.

Conversations with Provost & Vice Chancellor for Academic and Student Affairs, Joseph Hartman emphasized the campus focus on addressing vacant land, landscaping, and traffic safety. One goal Provost Hartman identified was encouraging commuter students to spend more time on campus and in the city. He also identified the importance of this task for attracting faculty, who desire a campus and city workplace with amenities that allow them to, for example, walk to lunch. Transportation improvements in the city, especially those that enhance walkability have helped move the campus towards this goal. Provost Hartman also discussed that a goal of campus and city improvements, including the LINC project, is to improve the ability of residents and students to live, work and play in the city itself. The city and the campus are closely partnered in making these improvements.

The City

Property values in Lowell have increased in recent years and LINC is an opportunity to continue that momentum. Between 2011 and 2022 property values increased 33 percent in real dollar terms. Salem, another post-industrial Gateway City saw similar land value increases in that time frame. Other Gateway Cities have had slow or stagnant growth in property values. Worcester property values grew 24 percent between 2014 and 2021[12] and Fitchburg, a Gateway City with a public college at its core, only grew three percent (2012 to 2021). These land values suggest that LINC will build on the work already being done by the city, the campus and private enterprise to develop the city. This also suggests that Lowell has some advantages compared to other Gateway Cities.

Work continues on improving sidewalks, the bus system and expanding bike paths. City Manager Tom Golden discussed that sidewalks in the city need attention: "How you traverse through a city is extremely important." and that the city was spending money to improve them. Investments in the walking infrastructure are also important, with the city planning to install additional wayfinding signs throughout the city, including the LINC area, to direct people to points of interest such as restaurants.

[11] UMass Lowell article which details bridge improvements: https://www.uml.edu/news/stories/2022/new-canal-bridges-improve-student-commute.aspx

[12] Land value data is based on an analysis of property records which are updated sporadically by different municipalities, resulting in different time periods.

These investments are key to placemaking, which will help make Lowell more accessible and enjoyable for residents.

The city is actively interested in improving the density, variety, and availability of residential housing. City Manager Tom Golden emphasized that future growth in Lowell must be vertical: "…the density that we have, we're trying to go up. We can't go out. We can't go horizontal. We need to go vertical.". Manager Golden emphasized that Lowell was among the first municipalities to prepare a plan to meet the requirements of the MBTA commuter act, a state law which incentivizes the planning of denser residential zoning in the immediate area around commuter rail stations. The city has ownership of five parcels near the commuter rail station and is seeking developers for that area. In pursuing additional residential real estate, Manager Golden discussed that the city is actively pursuing a diverse housing mix: "…what we want in the city of Lowell is home ownership: affordable home ownership, and market rate [home ownership]". LINC will synchronize with these developments. Residential and Commercial activity in LINC will benefit from access to the commuter rail. Development around the commuter rail will benefit from the improvements of LINC. From LINC in the north to the commuter rail in the south of the city, there will be a neighborhood sized transformation as new (LINC), and existing (Hamilton Canal Innovation District) projects become stitched together with Lowell's existing commuter rail and downtown.

The intent of this work in housing is to provide more opportunities for Lowell residents to start building generational wealth through home ownership whether they need affordable or market rate housing. Manager Golden sees this work as giving people a chance at the American dream. This is a reminder of the promise implied by Lowell being named a Gateway City: "the Golden Administration, if you will, as well as the city council…we're very excited about advancing people and giving people the opportunity for that. 'American dream' where people have the opportunity, whether young or old, to grow true generational wealth." The city is already progressing towards this goal, with the construction of additional affordable housing recently including 32 units of owner housing at 652 Merrimack Street for those making at or below 100 percent of area median income. 652 Merrimack Street is just one of many new developments in the Acre neighborhood. These residential investments in various parts of the city but particularly near commuter rail will synchronize up with LINC which is a short distance from the commuter rail and will itself include market rate housing.

Lowell's Future and the Lowell Innovation Network Corridor

The LINC project will make the city attractive to a wide variety of employers and provide space for research initiatives on campus to spin off into startups that will aid in the city's development. As such, LINC represents a critical next phase in Lowell's history and continued development. Since its founding, Lowell has been a place where the latest innovations from around the world have been put to productive use. Manager Golden identified how the LINC project is part of that history:

…once again, the city of Lowell continues to remake itself, as it has from 1826 to present. We're coming up on 200 years in a city, [that] was built specifically for mills, specifically for the water, specifically for waterpower. So, It's not shy to reinvent itself. To keep the old, to keep the concrete of businesses that have been here forever. But to build on that foundation and stretch out into a different area. And we're doing that with the University…

With UMass Lowell, the city has become a center of innovation. Rather than adapting ideas from elsewhere, Lowell is applying its innovative spirit to cultivate, develop and implement innovative technologies locally.

LINC Project Description

The LINC project will create over 1.2 million square feet of new real estate space in the city of Lowell. This work will occur across several phases. Each phase will require investments in infrastructure, particularly improvements to the roads and bridges that connect LINC with the city. Improving walkability is a key goal of this infrastructure work. Walkability is an important part of placemaking as mentioned earlier in the discussion of the city's development efforts. Improvements will include better traffic patterns, bridges, and improvements to the general aesthetics of the area. The area where LINC will be will include people traveling from Centralville and Dracut, East Campus, other parts of the Acre and will link them to downtown, the Hamilton Canal Innovation District, the commuter rail station, and places of business throughout Lowell.

The initial work (Phase zero) is already beginning and is centered around Wannalancit, enhancing that existing property, and moving new employers into the space. Draper has already moved 50 employees into Wannalancit and are planning to increase their employee presence significantly as more space becomes available to accommodate their expanding microelectronics division.

Phases one and two of the projects will include industry space which will allow private employers to have a presence on campus near campus resources including faculty and the student body. This phase will also include nearly 500 units of housing intended for young professionals. Phases one and two are set to begin in 2025 and to be occupied by 2027. The third phase of the project will add over 450 beds of student housing to the project.

In July 2024, the Lowell Innovation Network Corridor received another member through a partnership with Mass General Brigham. Together, UMass Lowell and Mass General will develop training materials for law enforcement, the military and emergency services. This work will leverage campus and Mass General Brigham research into kinesiology, exercise physiology, neuroscience, and life sciences. The partnership will connect with the UMass Lowell HEROES program, empowering research in that existing program.

Provost Hartmann discussed the potential for new commercial spaces in LINC to host spinoffs of local eateries. Lowell has an incredibly complex culinary life, driven by the diversity of the city's residents, many of whom are immigrants and the descendants of immigrants from all over the world, and it is important that LINC support those local businesses. The workers and residents in LINC will be a short walk from the commercial corridor around Merrimack Street in the Acre Neighborhood. The Acre is home to hundreds of businesses and now LINC. The development of LINC will boost business in the Acre, which is already undergoing dramatic economic transformation. The Acre has experienced less business turnover than downtown and other neighborhoods. All of those interviewed for this project emphasized that the downtown neighborhood, east of the Acre and Merrimack Street, had immense potential but that it did not yet have enough activity to act as a vibrant downtown. LINC will add critical mass in terms of residents, workers, and students and thus link more people to Lowell's Acre and downtown.

An Investment in the Future of the Commonwealth

The state is currently facing a crisis of affordability and demographics. Massachusetts is the third most expensive state for cost of living in the first quarter of 2024[13] and it is older than the U.S. overall. UMass Lowell Chancellor, Julie Chen, expressed how the LINC project can be an important lever to address these issues by providing opportunity for the next generation:

> *We're excited in terms of helping our students get paid internships, but also making sure that students, when they graduate, don't feel like they have to leave the state… They can find a place that's affordable to live, they can have a great job. All that combination helps us to keep the 25- to 35-year-olds in Massachusetts so that they will stay and not feel like they have to go to some other state… If they leave in that stage, then once they start having families, you're not going to get them back… We want to keep them here, and if you can keep that talent pool here, that's how you keep the companies here.*[14]

LINC offers housing for students and graduates of UMass Lowell and residents of the city who may go on to work locally at companies like Draper, Raytheon, and UKG among many other leaders in the tech economy. By making Lowell a more desirable place to live, work, and play, Lowell can become a more sustainable place for current and future residents. The city is very aware of the importance of affordability, which is why throughout the city, there are plans to develop a diverse housing mix of affordable and market rate housing. LINC will complement and support those efforts.

Similar Projects

There are two primary developers for the LINC project. Wexford Science & Technology, a developer of mixed-use properties with a focus on scientific research and GMH properties, developers of residential housing and dormitories. Wexford has developed spaces similar to LINC throughout the country. One recent project was in collaboration with Drexel University and the University of Pennsylvania in Philadelphia. Wexford worked with Drexel to build uCity Square which included 6.5 million square feet of residential, commercial, research and education space.[15] Similar to the site of the LINC project, the area of the development had also undergone displacement during urban renewal in the 1960s. The hoped for and long-promised economic development of the area had not fully materialized since that time. Decades later, the uCity Square project presented an opportunity to heal some part of the damage done by urban renewal, bringing additional housing and businesses to the area, and supporting the rebuilding of two local elementary schools as part of the project.

In 2019, Wexford completed work on an innovation center in Providence, Rhode Island in collaboration with Brown University[16] which housed offices for Brown University staff and more recently has been transformed to include wet-lab space to attract life science companies[17] The development was in the

[13] According to C2ER's Cost of Living Index: https://meric.mo.gov/data/cost-living-data-series

[14] Boston Globe *UMass Lowell embarking on strategic expansion*: https://www.bostonglobe.com/2024/03/27/metro/umass-lowell-embarking-strategic-expansion/?p1=Article_Inline_Text_Link

[15] https://wexfordscitech.com/community/ucity-square/

[16] Article on the Ribbon Cutting of the Wexford Innovation Center in Providence: https://www.brown.edu/news/2019-07-17/innovation

[17] Wexford article on lab improvements to the Providence development: https://wexfordscitech.com/open-for-leading-edge-science-new-brown-wet-labs-open-at-point-225-in-providence/

city's economically distressed jewelry district (the jewelry industry, once a leader in Providence, has confronted large-scale decline since the 1970s) and coincided with a number of large developments such as the renovation of a derelict power station in the area into office spaces for the University. Other Wexford projects include an innovation center in collaboration with the University of Maryland in Baltimore, University Technology Park on the campus of Illinois Tech in Chicago and Pittsburgh Knowledge Community, a collaboration with the University of Pittsburgh. Wexford has a strong track record of working closely with universities around the country, but particularly in the Northeast to engage in innovative, public-private partnerships. Many of these projects are tied to a community with a history of economic challenges and urban renewal, like Lowell.

Wexford is not the only developer working on projects like this. Other cities and universities are engaging in public-private partnerships centered around development. In New Haven, Connecticut a city infrastructure plan called Downtown Crossing seeks to connect downtown to surrounding neighborhoods[18]. Downtown Crossing is centered around walkable streets with improved bike access. This infrastructure project has drawn considerable interest from private industry. In 2021, Yale became tenant in the project agreeing to occupy significant office and laboratory space in a proposed development in the area.[19] This New Haven development is based on public investment in infrastructure to create privately driven economic growth in a post-industrial New England city. LINC is an opportunity to encourage similar growth throughout Lowell. Like Yale, Drexel, Brown and many other universities, UMass Lowell recognizes that developments like LINC with strong benefits for the surrounding community are vital to building a sustainable education ecosystem. Investments in LINC will have positive impacts on neighboring parts of the city.

Impacts on the Rest of Lowell

LINC will have spin off effects on the rest of the city, Manager Golden feels the project will unlock further potential in other parts of the city: "I think that it's intoxicating what LINC is doing because people are really talking about [it]. What can we do on Merrimack Street? Which is in the center of downtown. What can we do on Market Street? Which once again is in the center of our downtown… What can we do on Palmer? On Middle Street, on Central Street… People are really getting excited." As mentioned earlier, LINC will align closely with Lowell's downtown, amplifying commercial activity and foot traffic in that area. Richard Howe feels that this will help keep people in and around downtown:

…one of the problems with the Tsongas Center was that people would drive to it. They'd park in the garage. They'd go in. They'd see a great game, a great concert. Then they'd walk back to their cars and drive away… It was inconvenient to go to dinner or go somewhere before or afterwards, and so the more the University can extend towards downtown, and downtown can extend towards them, and sort of merge it all together. I think it would be fantastic, that to me is like the hope for downtown Lowell to revive as a traditional downtown area.

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[18] City description of the Downtown Crossing Project

[19] Yale news article on 101 College Street in New Haven: https://news.yale.edu/2021/05/21/101-college-yale-helps-seed-flourishing-future-new-haven-biotech

LINC will help the campus connect more closely with the city's urban fabric. The LINC project will also increase economic activity in and around the Acre. As mentioned earlier, improvements have already been made to the bridge infrastructure connecting LINC to the rest of the Acre. Richard Howe was excited at the possibility of bringing more activity to such an attractive area of the city along the Merrimack River. He shared his experience hosting tours of the center of the city. While the area could be quiet at times, he found that when an activity such as a tour was offered, he was able to attract hundreds of people at times. His experience suggests that a kernel of increased activity could rapidly bring in additional foot traffic and interest to the area. The Acre and Merrimack Street overlap with the city's transformative development district (TDI), designated in 2022, which unlocks more capital and opportunities for economic growth including support from Mass Development.

Work done for LINC will positively advance goals of the city's Sustainable 2025 plan which calls for transforming Lowell to be a more "vibrant and unique urban hub". [20] To achieve this goal the plan encourages diverse commercial businesses, prioritizing locally owned businesses. Conversations with the campus and the city suggest there is a strong interest in developing the commercial sector in and around LINC and ensuring that local businesses are part of that process. The plan also supports reuse of existing mill buildings, improvements to accessibility in and around downtown, and making the most out of the city's canals, actions LINC can support. LINC is conducive to the Lowell Open Space and Recreation Plan (OSRP) which calls for preserving access to Lowell's historic resources, such as the mill buildings and natural resources such as the river. The OSRP also advocates for improved infrastructure including sidewalks and canal paths, investments in LINC will help improve this aspect of the urban fabric. Increased use of the rail station, driven by activity in LINC, will boost demand for residential and commercial space near the rail station such as in the Jackson, Appleton, Middlesex (JAM) area. Manager Golden expressed interest in densifying that area by building upwards. Manager Golden noted a number of vacant lots in that part of the city which could be put to better use. LINC will boost demand for this kind of revitalization.

As will be discussed in detail towards the end of this report, the LINC development will produce around $17 million in annual tax revenues at various levels (local, state, and federal). This is an estimate based on the amount of industry activity expected to occur as a direct result of LINC development (based on December 2023 project assumptions which have likely grown since then due the advent of Draper and Mass General Brigham joining the project). This does not include the potential for spin off effects. Namely, greatly increased property and meal tax revenues if LINC can attract more residents, students, and visitors to the area, who can patronize local businesses. The potential for startups to spin out of the campus and local private employers, and then settle in LINC to begin to grow locally, means additional potential for increased tax revenues locally.

LINC is a major investment in the city. Unlike many other college campuses, UMass Lowell is an inextricable part of the city's urban fabric. Investments in LINC will have positive effects on neighboring areas of the city and the campus. LINC's focus on working with private employers delivers on the economic development promises made throughout Lowell's post-industrial era.

[20] City of Lowell's Planning & Development Documents: https://www.lowellma.gov/516/Planning-Development

Urban Revitalization: Conclusion

Lowell's long history of innovation will be further propelled into the future by the Lowell Innovation Network Corridor project. Lowell has continually evolved and transformed, beginning as a center of manufacturing for the United States and much more recently playing important roles in the development of computer technologies and defense-related industries. Since its founding, Lowell has periodically gone through challenging economic cycles but has always prevailed. Throughout its history and challenges, the city of Lowell has developed a diverse culture built through the work of Lowell's residents. The strength of the people of Lowell has allowed them to weather tough times and seize opportunities as they emerge. Whether it was Lowell acting upon a revolution in transportation to bring trains to New England for the first time, or citizens advocating for the creation of Lowell Historic Park, the city has never sat idly by and waited for things to change. Early industrial technology that was originally developed in England was masterfully harnessed by Lowell to create one of America's largest manufacturing hubs. When the computing revolution emerged on the West Coast, Lowell quickly became home to one of that industry's biggest players on the East Coast. Today, with the presence of UMass Lowell and a corps of tech companies in the city and surrounding region, the city is increasingly the innovator that is developing technologies others will want to implement. Importantly, the high-tech research space proposed in LINC is not tied to any one product but rather to a full range of STEM fields from life sciences and textiles to robotics and nanotechnology and beyond. The campus and the city are thus on the frontline of emerging technologies.

The city and campus have worked and continue to work together to make Lowell a more vibrant place for residents as well as students. The city is on an upwards economic trajectory and that momentum can be carried forward into a new era of economic development and urban revitalization. LINC will connect more employers with the city and campus. LINC will house innovators and their collaborators. LINC will inject additional vibrancy into the city of Lowell, the city's downtown and neighborhoods like the Acre. The LINC project will create a positive feedback loop between the commuter rail, downtown, and the campus. The city is working to ensure a diverse housing mix to make sure there is plenty of room for current and future residents. A new neighborhood of innovation is forming, with benefits for the city and the campus.

LINC is not the only project of its kind, other universities and colleges have recognized the value of public-private partnership to unlock greater development opportunities in their communities. Proximity to Greater Boston's constellation of research institutions and innovation companies provides a pool of employers that are likely to be attracted to the mix of amenities and attributes offered by LINC and the city of Lowell. At the same time, UMass Lowell is cultivating start-ups that will be employers of the future. LINC is a historic opportunity for the city of Lowell which can launch a new chapter in Lowell's urban revitalization.

In the next section, the positive impacts on student attraction, enrollment and retention will be examined. LINC will have a substantial impact on bringing in and keeping students to the UMass campus. LINC is an urban development in line with investments being made by and in partnership with large research universities around the country, including those in the Northeast like Philadelphia and Providence.

Student Attraction and Retention

Colleges and universities across the country are having to compete more aggressively for students as they confront demographic headwinds showing relative declines in the student-age population in coming years. There are many strategies universities can apply to maintain and improve their attractiveness to prospective students, including bolstering their academic reputations, improving and expanding facilities, and adding amenities to promote a strong sense of community across campus. The Lowell Innovation Network Corridor (LINC) initiative targets many of these key components with a focus on urban revitalization in the City of Lowell, a mechanism through which UMass Lowell has the opportunity to enhance its reputation, improve student and faculty experience, and further stand out among competitors.

Historically, strong linkages between urban environments and their local universities have been mutually beneficial for universities and the communities in which they operate. Collaborating to drive economic development maximizes capital and financial resources, increasing the University's capabilities to attract and retain talented students and professionals and improve institutional reputation. A few examples of this success include Pennsylvania State University and University Park, Pennsylvania; University of Maryland and College Park, Maryland; Yale University and New Haven, Connecticut; Trinity College and Hartford, Connecticut; and Drexel University and Philadelphia, Pennsylvania.

This section aims to demonstrate that the LINC initiative along with urban improvements will add to UMass Lowel's overall appeal for students.

UMass Lowell, Lowell, and LINC

In the late 1800s, two schools formed on either side of the Merrimack River. The Lowell Normal School was granted a charter to prepare teachers for the region's expanding schools while the Lowell Textile School was formed to produce skilled workers and technicians needed for the city's booming textile industry. The two merged to create the University of Lowell in 1975, and eventually joined the UMass System in 1991, creating the UMass Lowell of today.[21]

Since then, UMass Lowell has evolved both in its physical infrastructure and in enhancements to its academic and research capabilities. Twenty-two University buildings stretch across the University's three campuses, North, South, and East Campus. Among these are six different laboratories ranging from simulation and observation facilities for health and social sciences to biomedical, chemical, and environmental engineering. On-campus partners offer lab experience for students in nanotechnology, nanomedicine, molecular biology, and plastics engineering. While most of the academic buildings are found on North and South Campuses, East Campus is home to the campus recreation center and Tsongas Center, as well as residential halls. About 4,400 students, (26 percent of the student body) live on campus in one of UMass Lowell's 10 residence halls, which range from suites and apartments to

[21] Celebrating 125 Years of UMass Lowell: https://www.uml.edu/125/

living-learning communities.[22] UMass Lowell also has 24 University research centers and institutions, with 15 research labs available on campus.[23]

Campus Trends

In 2022, UMass Lowell enrolled 17,153 students, 12,389 (72 percent) of whom are undergraduate students. Between 2012 and 2022, the University's student population grew five percent overall, driven by a 19 percent increase in the number of graduate students (See **Figure 12 in** the Appendix). This has occurred despite demographic headwinds reducing the number of young people in the region, and in a period in which many other major northeast universities have been unable to grow their student population. The graduation rate in 2022 was 71 percent, and the retention rate was 84 percent. UMass Lowell has over 120 undergraduate programs, 39 master's programs and 33 doctoral programs. There are 70 different graduate certificates available and 40 minors.[24] About 90 of these programs are available online, and about 40 of them can be completed with a mix of online and in-person classes.[25] 4,847 degrees were conferred in 2022, with the top programs being Business Management Marketing (26 percent of degrees), Engineering (19 percent of degrees), and Computer and Information Sciences (10 percent of degrees). [26]

As the student population grows, so do the demands on the campus to provide sufficient research space. As a leading research institution in STEM education, the University's strengths are highlighted by its consistent investment in these spaces across the City of Lowell. Projects like the Saab Emerging Technologies and Innovation Center (EITC) have created space for entrepreneurs, students, and faculty to conduct advanced research. This space has attracted private companies like Raytheon, who created the Raytheon UMass Lowell Research Institute (RURI), specializing in printed electronics and nanotechnology, where important work is done for clients like the U.S. Department of Defense. These partnerships created a pathway to careers for UMass students, who get hired at higher rates in these companies, and gain valuable, hands-on experience that sets them apart in their careers[27]. These facilities provide unique opportunities for UMass Lowell students that cannot be found on most other college campuses. They connect students with potential employers, unlock research opportunities with real-world relevance and aid students in finding their research and career interests. These facilities provide a great foundation which LINC can better leverage and build upon.

LINC and the UMass Campus

The Lowell Innovation Network Corridor (LINC) will provide more opportunities for collaboration between the University and the private sector, all the while raising the University's reputation and competitiveness. LINC, along with the campus' existing investments and partnerships such as ETIC and the Raytheon Lab, will further enhance UMass Lowell's reputation as a leading institution in STEM research. Even as the academic and research reputation of the campus continues to rise, perceptions of the City of Lowell will continue to be a factor affecting UMass Lowell's reputation and competitiveness, and therefore play a key role in its progression. Challenges, some real and some perceived, include

[22] About UMass Lowell: https://www.uml.edu/about/
[23] UMass Lowell Virtual Tour: https://www.youvisit.com/tour/63581/?pl=v&message=failed-embed-redirect
[24] UMass Lowell Academic Catalog: https://www.uml.edu/catalog/
[25] UMass Lowell Academic Programs: https://gps.uml.edu/academic-programs/
[26] IPEDS
[27] Insight provided by university officials.

safety concerns (e.g., vehicle/pedestrian incidents, and even a single high-profile crime can receive considerable media attention despite the dramatic decline in the crime rate in recent years), costs of housing, and ultimately the community feel and experience of UMass Lowell.

Challenges

Some issues the University faces in recruiting students are due to economic concerns – UMass Lowell officials have recognized trends for potential students who opt out of school since they are unable to support themselves or their family without working full-time. From a recruitment perspective, this is an issue that expansion through the LINC initiative can address. Through new partnerships, co-op opportunities, and internships, University officials see expanded opportunities for students to attend school while being employed. Teaching labs provide a space for research and industry collaboration, giving students real-world experience that leads to better co-ops and jobs.

UMass Lowell faces tough competition for recruiting advanced professionals, specifically domestic PhD candidates, from the many prestigious institutions in Boston, especially for STEM fields. Expanding research spaces and partnering with industry and government initiatives has boosted UMass Lowell's visibility as a competitor in the STEM space, with STEM becoming the fastest growing program pathway on campus.

UMass Lowell has grown rapidly, and the city has changed dramatically over the years, but there have been setbacks. A UMass Lowell official describes the state of UMass Lowell before the COVID-19 pandemic as being on the "cusp of vibrance". From a student perspective, LINC has the potential to return and unlock some of the vibrance that is on the horizon for UMass Lowell. LINC incorporates large investments in research and development space, housing, commercial space, and substantial infrastructure investments to support these developments. The project has a committed anchor tenant in the non-profit Draper of Cambridge, which is expanding its microelectronics division into Lowell by leasing space in Wannalancit with plans to lease newly built research space developed as part of phase 0 of the LINC project.

The additional research space paired with additional housing and commercial space will provide a clear path for growth for future startups, which create visible and trusted career pathways for students. Researchers in these spaces can collaborate closely with students and faculty in an off-campus environment, the kind of activity that is attractive to prospective students. The secondary effects of this expansion include enhancing infrastructure and amenities in and around campus, which can improve walkability and safety and encouraging students who live on or off campus to spend more time in Lowell. Getting students to spend time on campus has long been the key to UMass Lowell's growth, with a one in three chance that potential students will enroll once they step foot on campus. The LINC initiative is yet another tool that can be used to increase the University's attractiveness and add to its competitiveness.

The following section will review similar initiatives at universities in the Northeast region of the United States. Several esteemed institutions have invested in urban revitalization efforts in partnership with the communities in which they are located and have successfully improved their campus and community, to the benefit of their students. These institutions are not all public research universities, but they share many of the same challenges as UMass Lowell. They are integrated into the urban fabric of their cities, cities that have experienced economic headwinds and challenges such as safety and job prospect concerns. But these cities are also filled with opportunities that can only be found in urban

environments (e.g., density of cultural amenities, venues, restaurants, public transportation, etc.). In many cases, these schools are trying to grow and revitalize communities that have suffered from a history of misplaced development, particularly in the era of Urban Renewal. Lowell is going through many of these same challenges and the case studies identify how a project like LINC can empower an era of shared prosperity for the UMass Lowell campus and the city. These case studies describe the challenges, strategies, and successes of universities who understand how smart investments can bring in more students.

Case Studies

Trinity College – Hartford, Connecticut

Founded in 1823. Trinity began as Washington College, the second college in the state of Connecticut. Trinity today is a liberal arts college with just over 2,000 students. Based in Hartford, Trinity's campus is in the southwest of the city. Hartford was a manufacturing hub for decades which experienced a severe downturn in the middle of the 20th century. The city has struggled with elevated levels of poverty and issues of segregation both by race and income[28]. These issues can make it challenging for Trinity to attract and retain students even as a highly ranked liberal arts college. To help address Hartford's challenges and to improve Trinity's own ability to provide excellent education for students, Trinity began investing more heavily in the city.

In the late 1990's Trinity began construction of a "learning corridor", revitalizing a neighborhood adjacent to the Trinity Campus and constructing four magnet schools for children of all ages and a Boys and Girls club.[29] The project was funded with help from local healthcare institutions and the state. The intent of the project was to have over 50 percent enrollment from the surrounding neighborhood. This ambitious level of local enrollment never quite materialized but the schools still had a positive impact on the community and the project symbolized a new era in how Trinity engages with the city. The campus gained the benefit of a substantial redevelopment adjacent to campus, amplifying the attractiveness of the area for new students. Trinity also benefitted from the downstream effects of improved education regionally, improving quality of life for Hartford residents and, by extension, the student body.

The new magnet schools provide learning opportunities for Trinity students through partnerships like the Hartford Magnet Trinity College Academy (HMCTA)-Trinity Partnership. This early college experience partners HMTCA, one of the interdistrict magnet schools in the Learning Corridor campus, with Trinity College. From its start in 2011, the partnership continues to create opportunities for students and faculty at Trinity and HMTCA to build connections and learn from each other.[30] Through the Learning Corridor, the city gained improved access to programs like this and access to quality elementary and secondary education.

Trinity has continued to engage with the city, more recently investing in downtown Hartford, including opening the Trinity Innovation Center which provides space for entrepreneurship programs for students and a startup accelerator in cooperation with Infosys. Trinity is not alone in investing downtown. A 2019 Connecticut Public Radio report on the developing relationship between colleges and universities and

[28] CT's racial and economic segregation among worst in the country, report finds: https://www.ctinsider.com/news/article/report-ct-s-racial-economic-segregation-among-18623586.php

[29] Overview of Trinity's Learning Corridor Project: https://www3.trincoll.edu/comms/reporter/W01/Corridor.htm

[30] Trinity College, HMTCA-Trinity Partnership: https://www.trincoll.edu/cher/hmtca/

their host communities identified that Trinity was only one of four institutions moving into Hartford's downtown: "As recently as 2001 not a single college had a presence in downtown Hartford. Now four do: Trinity, the University of Connecticut, the University of St. Joseph, and Capital Community College."[31]

Trinity is an excellent example of an educational institution recognizing the value of investing in their community. Not only is that investment part of being a member of the community, but it is also a signal to students and faculty that the campus wants to cultivate a healthy learning environment. Now, 20 years later, students and residents are reaping the rewards that the learning corridor has to offer. Students at the HMTCA reported feeling more prepared for and comfortable with navigating college campuses and college level work. Neighborhoods have benefitted economically as homes located adjacent to the learning corridor have become highly desirable for their location near the school campuses.[32] In terms of Trinity student perceptions, many students reported a positive change in their perceptions of Hartford as a result of their involvement in the community through internship experience.[33] Similarly, LINC can act as a bridge to the surrounding community by providing a place that students, faculty and current residents can all enjoy.

University of Maryland - Main Campus – College Park, Maryland

The University of Maryland (UMD) is a public, R1 research university with its main campus located in College Park, Maryland, and is known as the flagship University of the University System of Maryland. The land-grant university was chartered as a state agricultural school by the General Assembly in 1856.[34] UMD is the only public research university inside the Washington, D.C. Beltway and has become known as the academic research hub of the region, forming partnerships with national institutions and federal agencies.[35]

College Park is located near the border between Maryland and Washington, D.C., close enough to house its own stop on D.C.'s subway system. Students often utilize the Metrorail and Metrobus system as an inexpensive and convenient way to travel into D.C. and the surrounding suburbs.[36] The city has long been a center of education, experimentation and exploration even before it was known as College Park, taking its roots from notable innovators like the Wright Brothers who in 1909 accomplished many aviation firsts in the College Park Airfield. College Park incorporated as a town in 1945 and today is a thriving city with more than 30,000 residents.[37]

In 2015, College Park was falling short of expectations for the "college town" feel. For example, University Boulevard, bounding the northern part of campus, is a divided highway designed for cars and commuters rather than bikes and pedestrians.[38] Despite being a major player in the region's academic

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[31] Colleges Help Drive Urban Revival, But Town-Gown Relationships Can Be Fraught: https://www.ctpublic.org/education/2019-10-13/colleges-help-drive-urban-revival-but-town-gown-relationships-can-be-fraught

[32] Reflecting on the 20th Anniversary of the Learning Corridor: https://www.trincoll.edu/cher/blog/reflecting-on-the-20th-anniversary-of-the-learning-corridor/

[33] Trinity College and Hartford: The Impact of Community Learning Courses and Internships on Student Perceptions of Hartford Courses and Internships on Student Perceptions of Hartford: https://digitalrepository.trincoll.edu/cgi/viewcontent.cgi?article=1711&context=theses

[34] University of Maryland, *History and Mission*: https://www.umd.edu/history-and-mission

[35] University of Maryland, *College Park*: https://www.usmd.edu/institutions/profile/?Inst=UMCP

[36] University of Maryland, *Where is College Park?*: https://aosc.umd.edu/about-us/visitor-guide/collegepark

[37] About the City of College Park: https://www.collegeparkmd.gov/253/About-the-City

[38] Greater Greater Washington, *Why isn't College Park a better college town?*: https://ggwash.org/view/38845/why-isnt-college-park-a-better-college-town

research, College Park was lacking the hotel and conference room space to accommodate conventions and visitors. The downtown area was not attractive to foot traffic, with residents complaining that the area lacked retailers, restaurants, and public places for residents and students to enjoy. Both College Park city officials and UMD's administration agreed that the area had the potential to be a premier college town, and thus the Greater College Park Partnership was formed.[39]

Greater College Park is a partnership created between the City of College Park, Prince George's County, the State of Maryland, private developers, and the University. Since its launch in 2015, the $2 billion public-private partnership has revitalized the community surrounding UMD as new businesses have taken root, housing options have dramatically expanded, and retailers have set up shop.[40] The city and University are committed to making this initiative an inclusive process centered around two-way communication, with the goal of creating a place where people want to live, work, and play.[41] Central to this vision is the process of connecting the Discovery District—consisting of a public-private research hub, the downtown community of College Park and the University of Maryland's academic buildings.[42]

One of the more significant projects to come from this partnership is the Hotel at the University of Maryland. Opened in fall 2017, the mixed-use project cost over $180 million and created more than 400 jobs. The 297-room, four-star hotel and conference center on campus acts as an anchor of Greater College Park, and now houses the Visitor Center.[43] The partnership funded more than 30 other projects, including more than two million square feet of development in multiple other mixed-use projects including office, residential, retail, and research space. Across the 150-acre research park are more than 60 companies, organizations, and federal agencies that together employ over 6,500 people, along with 62 acres of trails and parks and housing for over 4,000 students.[44] Other successes include reduced crime, home ownership programs for faculty, and the opening of College Park Academy Charter School.

The City of Lowell faces a similar challenge with the wide, car-centric urban streets creating safety hurdles for those walking to different parts of campus. Through LINC, the development corridor stretching across campuses from LeLacheur Park, across the Northern Canal to the Acre neighborhood, past City Hall, through the downtown area, and into the Hamilton Canal Innovation District to the research and lab space at 110 Canal St has the potential to greatly improve walkability.[45] A shared-use bike network path connecting this corridor, as discussed in the Transportation Master Plan, will provide a more direct route for cyclists and pedestrians to travel between the campuses away and protected from the street traffic, which will help appease safety concerns and increase student attraction. [46]

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[39] The Hyattsville Wire, *College Park Takes Big Step to Redo Downtown*: https://www.hyattsvillewire.com/2018/03/15/college-park-city-hall/

[40] University of Maryland, Maryland Today, *How We Picture Greatness:* https://today.umd.edu/how-we-picture-greatness

[41] University of Maryland, *Continuing to Build a Greater College Park*: https://greatercollegepark.umd.edu/continuing-to-build-a-greater-college-park-page

[42] ?

[43] University of Maryland, Maryland Today, *How We Picture Greatness:* https://today.umd.edu/how-we-picture-greatness

[44] University of Maryland, *Reshaping College Park*: https://greatercollegepark.umd.edu/

[45] The Lowell Sun, *Making Lowell's streets safe for bikes, kids*: https://www.lowellsun.com/2024/06/29/making-lowells-streets-safe-for-bikes-kids/

[46] UMass Lowell Bicycle Plan 2022-2027: https://www.uml.edu/docs/UMass%20Lowell%20Bicycle%20Plan%202022-2027%20web_tcm18-355949.pdf

Pennsylvania State University - University Park – State College, Pennsylvania

Pennsylvania State University is a public, R1 research university with its main campus located in State College, Pennsylvania. Pennsylvania's only land-grant university was chartered by the Commonwealth in 1855 as one of the nation's first colleges of agricultural science, with a goal to apply scientific principles to farming. Initially founded as Pennsylvania State College, the University moved to change the name of the town, State College, in 1953 when the institution was granted university status. The campus post office was officially given the zip code belonging to University Park in 1955.[47] As the University grew it established a series of undergraduate branch campuses, primarily to meet the needs of those students who were location-bound during the Great Depression. Today Pennsylvania State now has 24-campuses throughout the Commonwealth and enrolled just over 50,000 students in 2022.[48]

State College is a home rule municipality in Centre County, Pennsylvania. It is a college town, primarily dominated economically, culturally, and demographically by the presence of Pennsylvania State. As the population grew around the University, housing costs, traffic, and crime did as well. The city faced issues of balancing the needs of the University, the top employer in the county, and those of State College residents. To address these concerns, University administrators, students, and community members convened and agreed to work in tandem on the good and the bad. James Delattre, Associate Vice President for Research at Penn State, described the University's place in this partnership as an extension of its role as the state's land-grant university, noting "This service model is something that is in our DNA. However, we also recognize there needs to be more industry in the area beyond agriculture. We look at using the University to help support startups and create more local job opportunities as the 21st-century extension of that,".[49] As such, Penn State, in partnership with State College and the Commonwealth, launched Invent Penn State in 2015.

Invent Penn State is a Commonwealth-wide initiative designed to stimulate economic development, job creation and student career success. The $30 million initiative redefined the university's land grant mission to include entrepreneurship and innovation programs, funding tools and resources such as entrepreneurship-focused academic programs, business startup training and incubation, funding for commercialization, and collaboration across University, community, and industry leaders.[50] Entrepreneurs in all 21 Penn State undergraduate communities now enjoy free access to accelerator programs, coworking space, legal and IP advice, mentorship, rapid prototyping, pitch competitions and funding. The project was financed in part by a grant from the Commonwealth of Pennsylvania, Department of Community & Economic Development.[51]

Through accelerator programs, legal clinics, and other services, 7,021 entrepreneurs have been assisted to date engaging over 20,000 students and faculty. The accelerator programs created 654 internships, 411 new Pennsylvania companies, and 515 new jobs. Programs like the "Idea TestLab" and "FastTrack

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[47] Penn State, University Park, Pennsylvania: https://www.psu.edu/news/campus-life/story/university-park-pennsylvania/

[48] Penn State, *Our History*: https://www.psu.edu/this-is-penn-state/history/

[49] Higher Ed Facilities Forum, *How Can Universities Strengthen Town-Gown Relations?:* https://info.higheredfacilitiesforum.com/blog/how-universities-can-strengthen-town-gown-relations

[50] Invent Penn State, *Startup's Recent Success Tied to Penn State Entrepreneurial Ecosystem*: https://invent.psu.edu/stories/startups-recent-success-tied-to-penn-state-entrepreneurial-ecosystem/

[51] Invent Penn State, *Invent Penn State is a Commonwealth-wide initiative to spur economic development, job creation, and student career success*: https://invent.psu.edu/about-ips/

Accelerator" supported 819 startup program graduates, 528 product development projects, 371 of which have been completed.

From this investment the Innovation Park location was established, an ecosystem blending business, research, and development. Notably, Penn State opened the Innovation Hub, a $56.8 million new six-story building on South Burrowes Street located on the former site of the James Building. The Hub acts as a new home for the LaunchBox, previously located in a leased building on South Allen Street, with a community makerspace and state-of-the-art entrepreneurial and innovation resources. This Innovation Hub is thought of as the cornerstone of the entrepreneurial ecosystem developed by this partnership, both as a home for innovation and as a catalyst to grow the downtown, urban-feel.[52] The investment also moves the needle on the downtown master plan proposed by State College, which among other things aims to establish a framework for creating a memorable, attractive and comfortable downtown core that aesthetically unites the College Avenue corridor.[53] The LINC project can emulate the LaunchBox success by building on the Massachusetts Medical Device Development Center (M2D2) labs already on the UMass Lowell campus. M2D2 is already bringing in startups and giving new ideas a home, the LINC program will only create more room and resources for startups and therefore even more reason for students to choose UMass Lowell.

Yale University – New Haven, Connecticut

Yale University is a private Ivy League research university and liberal arts college located in New Haven, Connecticut. The University was founded in Saybrook, CT when the leadership of the Colony of Connecticut adopted a charter to erect a collegiate school in 1701. It officially became Yale College in 1718, one of nine colleges chartered before the American revolution. Yale shares the city of New Haven with the University of New Haven, Albertus Mangus College, Southern Connecticut State University, Davenport University, and Connecticut State Community College Gateway.

As a long-time resident of New Haven, Yale has always played a part in the city's urban development. The availability of cars and new roads out of the city after the world wars contributed to a mass exodus of the middle class from the city and into the suburbs. Economic conditions in New Haven declined as industrial parks and shopping centers popped up in these suburbs, replacing activities that had taken place in the city. Despite the efforts to revitalize downtown New Haven in the 1950s, the population continued to decline, and many retail and commercial businesses closed down.[54] Yale has participated in various projects over the years to target these issues, such as investments in commercial and residential real estate, resources to revive certain neighborhoods, and collaboration to spur redevelopment in others.

One of their successful partnerships is the New Haven Works initiative, a partnership among the City of New Haven, the University, and an array of community stakeholders. Beginning in January of 2012, a working group was convened to address unemployment and underemployment in the city.[55] The program seeks to address these issues by supporting the middle class in their urban center and improve

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[52] StateCollege.com, Penn State's New Innovation Hub in State College Aims to Spur Entrepreneurial Success and Economic Development: https://www.statecollege.com/articles/local-news/penn-states-new-innovation-hub-in-state-college-aims-to-spur-entrepreneurial-success-and-economic-development/

[53] StateCollege.com, *Penn State's New Innovation Hub in State College Aims to Spur Entrepreneurial Success and Economic Development*: https://www.statecollegepa.us/410/Downtown-Master-Plan

[54] City of New Haven, New Haven's History: https://www.newhavenct.gov/government/about-new-haven/new-haven-s-history

[55] New Haven Works, NHW History: http://test.newhavenworkspipeline.org/history

economic stability through workforce training and connecting residents to good jobs.[56] As a part of this initiative, the New Haven Works jobs program created a center for entrepreneurship in collaboration with major employers, small businesses, workforce development providers, support services, government initiatives, and labor organizations to provide a pipeline for jobs from skills and certifications to job opportunities benefitting both local employees and employers. Since opening in 2013, the New Haven Works jobs program has had 4,306 residents become members, referred 1,342 members to 2,423 positions, helped move 1,683 members moved to applicant pools, and helped 1,529 members get hired.[57]

As a part of the New Haven Works program, Yale University has enabled development of 101 College Street – a building project which is a key component of the city's Downtown Crossing economic development plan. The plan includes populating the 10-story building with over 525,000 square feet of lab, research, and meeting space between Yale's medical and central campuses with life science companies, a part of the transformation of the Route 34 corridor from an expressway into several walkable urban boulevards that will connect downtown New Haven with surrounding neighborhoods. The biotech incubator at 101 College Street will house New Haven-based biotech startups near the University's research facilities and provide resources for growing companies and support well-paying jobs. Along with a pipeline for permanent jobs, opportunities for employment during construction were available. Also, as part of this program, a classroom for New Haven Public Schools will be located within the building and a large open-air plaza will create opportunities for cultural equity and enrichment.[58]

Tenants for 101 College Street include Arvinas, BioLabs, and Yale University itself, with the expectation of adding approximately 860 direct jobs to New Haven and spurring over 3,000 indirect jobs to the local economy. [59] Recently Yale's Departments of Psychology and Neuroscience and the cross-disciplinary Wu Tsai Institute (WTI) moved into the building. The connective tissue that 101 College Street provides is evidenced in the backgrounds of new faculty, including Kia Nobre, professor of psychology and director of the WTI's Center for Neurocognition and Behavior; Emilia Favuzzi, assistant professor of neuroscience; and Shreya Saxena, an assistant professor of biomedical engineering. The collaborative space lends itself well to mend the divide that used to exist between the city and University and is on track to continue to "shape an ever more dynamic city corridor and finely knitted university community."[60]

Drexel University – Philadelphia, Pennsylvania

Drexel University is a large R1 research institution located near the University of Pennsylvania in West Philadelphia. Drexel was founded in 1891 as the Drexel Institute of Art, Science, and Industry[61], just a few years before the creation of the Lowell Normal School[62]. Drexel's main campus is adjacent to the University of Pennsylvania in the western part of the city. The two campuses comprise an area now

[56] New Haven Works, About Us: http://newhavenworkspipeline.org/about-us
[57] New Haven Works, About Us: http://newhavenworkspipeline.org/about-us
[58] Downtown Crossing New Haven, *Developing a Resilient & Inclusive Economy for New Haven*: https://downtowncrossingnewhaven.com/economic_development/
[59] Hartford Business Journal, New Haven's 101 College St. bioscience tower nears debut, as demand for lab space slows: https://www.hartfordbusiness.com/article/new-havens-101-college-st-bioscience-tower-nears-debut-as-demand-for-lab-space-slows
[60] Yale News, *At 100 College St., building connections inside and out*: https://news.yale.edu/2023/12/19/100-college-st-building-connections-inside-and-out
[61] Drexel history: https://drexel.edu/about/history
[62] UMass Lowell History: https://www.uml.edu/about/mission.aspx

known as “University City”. Philadelphia has faced challenges for decades, including high levels of poverty and crime. Given these challenges, both the city and neighborhood needed more active economic development and jobs. The campus, meanwhile, wanted to build an ecosystem of innovation, providing more opportunities for student co-ops, careers and for faculty to engage in collaborative research.

Drexel announced an ambitious $1 billion plan called uCity Square in 2014.[63] Drexel worked with LINC developer Wexford Science & Technology on the development plan which included 6.5 million square feet of residential, commercial and research space. The focus of uCity Square is transitioning research from the Drexel and University of Pennsylvania campuses to market and to nurture smaller high-tech startups. Additionally, the project provided over 400 units of residential housing created by LINC developer GMH Properties.

Just like LINC, the project included research space for students and faculty. The plan also included residential living adjacent to campus and employers to attract and retain younger, well-educated workers. The project amplified the educational capacity of the campus in high-tech scientific fields. The primary piece of the development included a health sciences building that became home to Drexel’s Colleges of Nursing and Medicine as well as its graduate school of Biomedical Sciences. The development site is also home to two public schools. As part of the project, the schools were completely rebuilt from the ground up and combined into one larger building, remaining on site. In addition to the collaboration with Drexel, the area is home to several other large mixed-use buildings constructed by Wexford, containing offices, lab space and additional housing. Tenants include a number of life sciences companies as well as various departments of the two campuses. The Drexel Health Sciences Building and the residential property opened in 2022.

The creation of a new health sciences building had direct positive impacts on the Drexel Campus. The project improved Drexel’s capacity to train students, providing room for high-tech education spaces such as an anatomy lab and simulation space. The new facility is featured prominently in Drexel’s admissions material, acting as figurehead for Drexel’s health science programs[64]. The Drexel-supported buildings were part of a larger development including more residential housing, and private office and laboratory space, meaning that Drexel students and faculty also gain access to a growing scientific hub, providing jobs, connecting students with real-world experience, advancing research and making Drexel a school where future opportunities are immediately apparent to everyone who considers attending.

The uCity Square project not only benefited the campus but also the city overall, fostering more interdisciplinary and professional collaboration across both communities and providing new educational facilities and access to more employers for existing residents of the city. The opportunity to convene a diverse group of learners is not lost on the University’s officials, who believe “collegiality and collaboration are core to who we are as a college, and this is a step toward furthering those qualities in our students, trainees, faculty and professional staff.”[65] LINC will likewise be a magnet for future students and faculty who are considering attending UMass Lowell.

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[63] West Philadelphia Collaborative History Project Description of the project: https://collaborativehistory.gse.upenn.edu/stories/market-corridor%E2%80%99s-millennial-building-boom

[64] Drexel College of Medicine, University City Campus page: https://drexel.edu/medicine/about/campuses/university-city/

[65] Drexel News, *Drexel Opens Health Sciences Building, Solidifying Its Place As a Leader in Health Care Education and Scientific Training*: https://drexel.edu/news/archive/2022/September/Drexel-opens-Health-Sciences-Building

Student Attraction and Retention: Conclusion

As evidenced in the successes of other university and municipality partnerships, the LINC project has the potential to boost student attraction and competitiveness for UMass Lowell. There are many ways in which this project is beneficial to the University and community, but in efforts to highlight the factors that influence student appeal, there are a few avenues by which competitiveness can be increased.

Additional educational resources unlock opportunities for students. Features of the LINC project, such as labs and equipment, programs, partnerships, and research institutions offer a mutually beneficial relationship – partners get access to a pipeline of talent and students get access to co-ops, jobs, and career pathways. Many students are seeking degrees with a job name in them, as the fear of pursuing a degree that does not translate to work is discouraging for prospective students. LINC can provide the stability that students need to commit to enrollment by creating more co-ops and internships and by building a relationship with potential employers.

Improved urban infrastructure in the City of Lowell improves the community feel and safety on campus. For a campus that is already divided across neighborhoods in the city, it is important to give students, faculty, staff, and visitors, alike, spaces that are convenient, inclusive, and attractive. The LINC initiative is an opportunity to improve and add amenities that will help build an urban environment to promote social interaction, including expanded dining options and pedestrian-focused design. The shared use paths proposed by the Transportation Master Plan along with LINC's plans to improve infrastructure in the area can provide pedestrian connectivity across campuses at UMass Lowell, and improved safety and walkability can provide the community feel that attracts more students. Traffic and parking are issues that could dissuade some future students, but with improvements to current infrastructure to create a more walkable and accessible campus, these barriers can be mitigated. Provost Hartman shares that the biggest avenue for increasing the likelihood of enrollment is to get prospective students to physically step foot on campus. Improving the visible attractiveness of campus and amenities throughout can help make UMass Lowell even more desirable and this is exactly what LINC can do.

More housing in Lowell attracts residents, talent, and jobs. The appeal of community feel extends beyond campus bounds, and housing availability and affordability are big contributors to a community's economic ecosystem. The new housing included as part of LINC, available for professionals and students, has the potential to attract those who are looking to be enrolled in or employed at UMass Lowell. With residents comes the probability of talent, in both students and faculty. The University attracts great faculty, according to UMass Lowell officials, and efforts are made to retain them in the face of competition from other universities. Faculty and staff who are considering UMass Lowell want to live somewhere along the picturesque Merrimack River, and especially somewhere that is walkable. The additional housing that is part of LINC can help ease these concerns. With more working residents and talented professionals in the area, the LINC project has the potential to attract even more industry partners and large institutions and therefore jobs. Housing, talented faculty, and job prospects all increase the attractiveness and therefore competitiveness of UMass Lowell.

Economic Ecosystem

The Lowell Innovation Network Corridor (LINC) initiative has the potential to be a "force multiplier" for both the city and the Northeast Massachusetts economies. Innovation, commercialization, and other business activities taking place in the corridor have the potential to grow new companies and be a catalyst for the growth of existing companies. Under this dynamic, companies may outgrow their LINC facilities and then choose to expand in the Greater Lowell region. Additionally, other businesses, sensing opportunity, may also be attracted to Greater Lowell as a location to expand their business. A process such as this would generate economic benefits well beyond those described in the quantitative economic impact benefits included in the final section of this analysis. However, this type of growth, while quite possible and representative of a desired outcome, remains an unknown and thus cannot be readily quantified unless it is part of an exercise to define future growth scenarios.

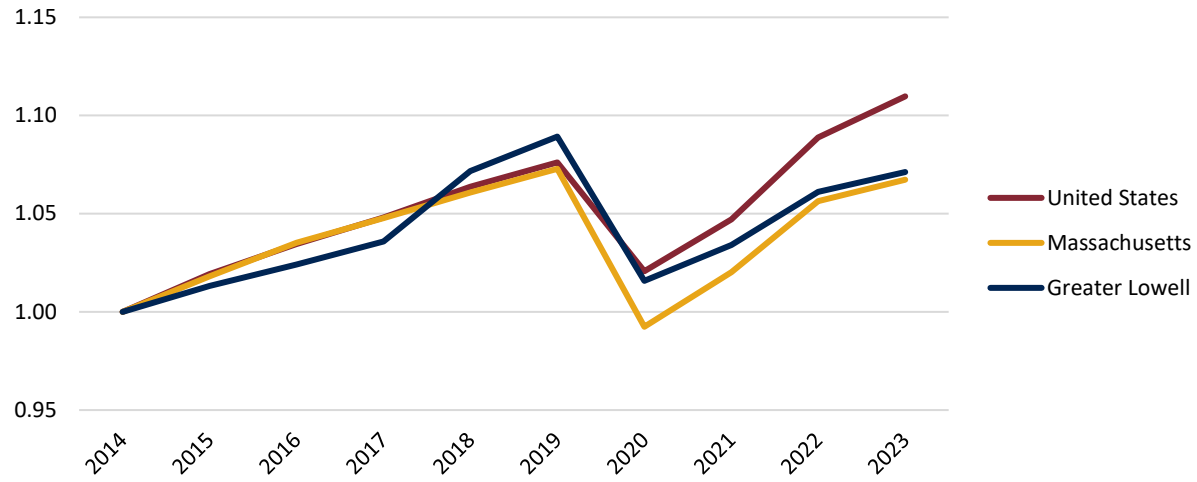
To gauge the potential economic effects of LINC, this section will analyze the economic ecosystem of Greater Lowell and how the new development could potentially fit in and serve as a catalyst for growth. This process includes assessing demographic and industry trends and projections, identifying key employers, and understanding the UMass Lowell initiatives, current and planned, that support innovation and commercialization. By considering the interplay between these forces, the role and potential for LINC to become a strategic contributor to the area's growth and competitiveness can be described and understood. The work in this report was also supported by interviews with university, economic development, and business officials.

Economic and Industry Trends

Greater Lowell is situated on the periphery of the metropolitan Boston area, one of the largest economies in the United States. The region follows state and national cycles in economic growth but has a distinct economy of its own with a particular concentration in government, healthcare, and manufacturing. This region is defined in this report by the Greater Lowell Workforce Investment area (WIA)[66], a region centered around Lowell which includes Billerica, Chelmsford, Dracut, Dunstable, Tewksbury, Tyngsborough and Westford.

[66] The WIA may also referred to as a Workforce Development Area (WDA).

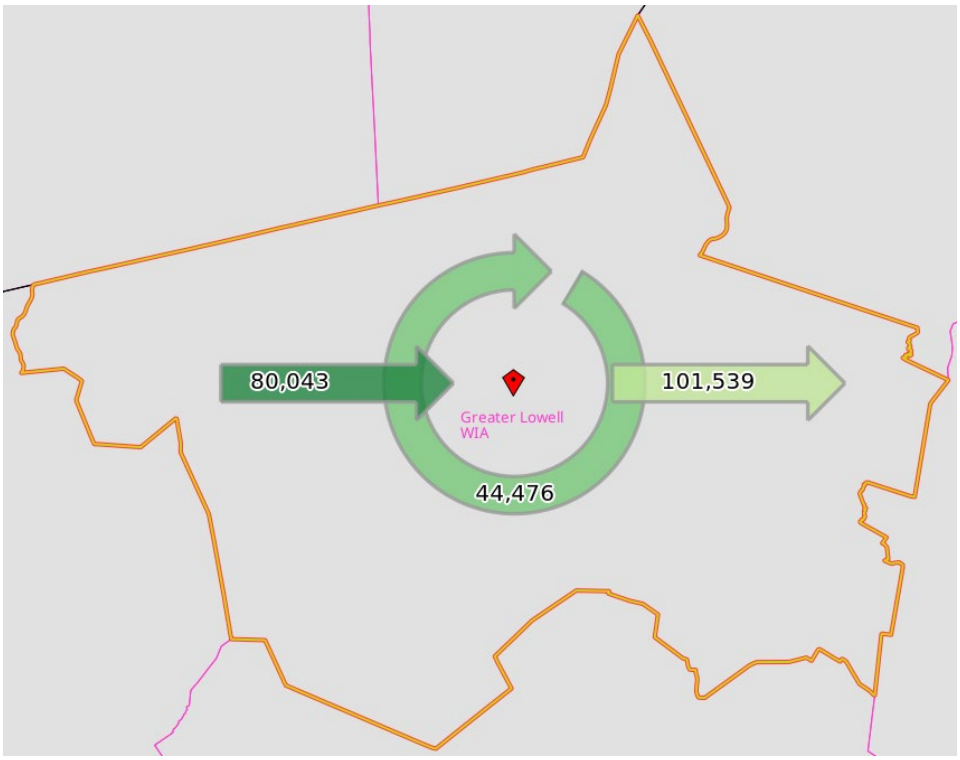
Figure 3: Employment Growth Index, 2014-2023



Source: Lightcast

Over the last decade, Greater Lowell's jobs growth initially lagged the state and nation, before accelerating above both in 2018 and 2019. The COVID-19 pandemic led to a decline in employment nationwide. Employment numbers fell to 2016 levels in Greater Lowell, but the region recovered much faster than the state overall. However, despite seeing a decline in jobs relative to the nation overall, Greater Lowell has been slower to recover, with job growth in the nation far outpacing the region.

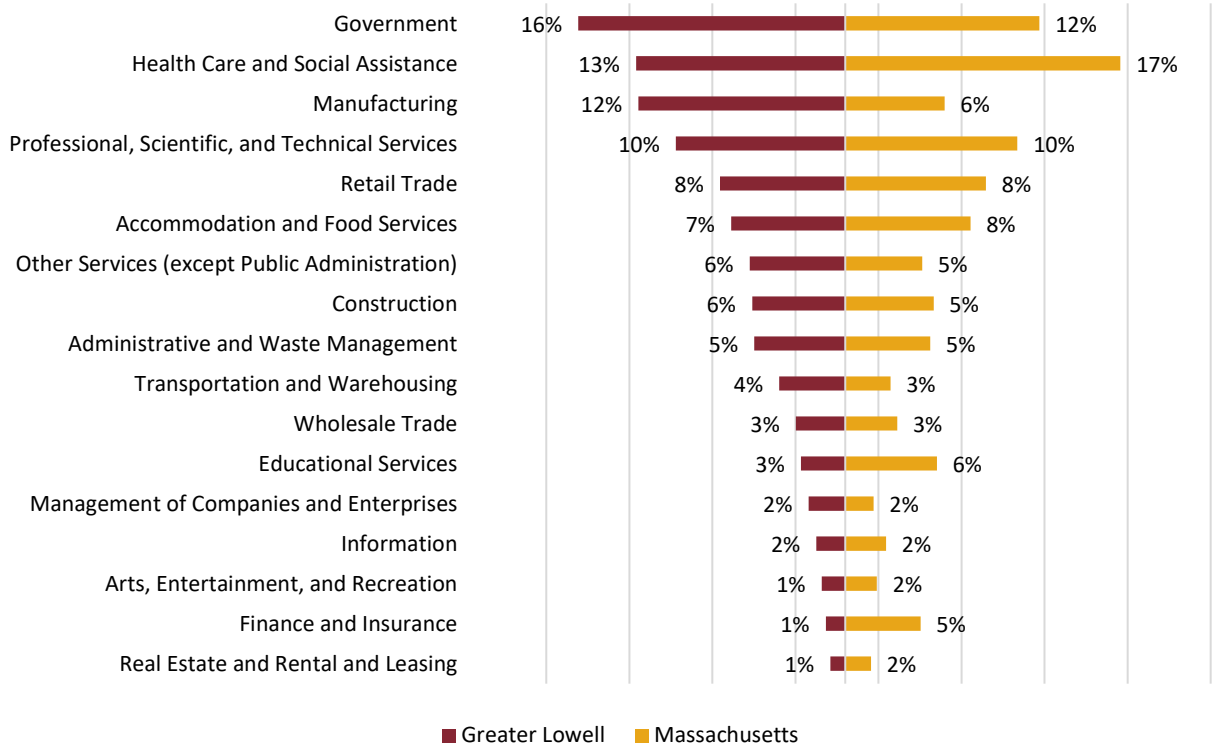
Figure 4: Greater Lowell Commuting Patterns, 2021



Source: US Census Bureau, OnTheMap

Greater Lowell experiences a significant inflow and outflow of workers in the region. While more than 44,000 people both live and work in Greater Lowell, an additional 80,000 people work in the region but live elsewhere. Due to the region's proximity to significant employment hubs in Boston and Cambridge, over 100,000 people reside within Greater Lowell but commute to jobs outside the region. The "hub and spoke" MBTA commuter rail system, including branches to Lowell, facilitates the large number of commuters from Greater Lowell into Boston, but does not efficiently connect Lowell to other cities within the region, such as Haverhill and Newburyport. Outbound commuters represent an opportunity for Greater Lowell, as talented people working in the Boston-Cambridge hub are often not aware of the job opportunities available within the region. High profile economic developments like LINC can encourage these outbound commuters to seek work within the region, avoiding long commuting times while maintaining the lower cost of living in Lowell compared to Boston.

Figure 5: Industry Mix, Greater Lowell and Massachusetts, 2023



Source: Lightcast

Greater Lowell possesses strengths (as measured by industry jobs concentration relative to the country's) in key sectors—namely government, manufacturing, and professional, scientific, and technical services—that are foundational to bringing in the types of innovative companies that UMass Lowell is trying to attract through LINC. Manufacturing in the region is dominated by precision instruments and medical equipment and makes up 12 percent of the industry mix, double the share in the state as a whole. The professional and business services industry is concentrated in research and development, engineering, and biotech, and makes up 10 percent of the industry mix, similar to Massachusetts overall. The government sector is the largest in the region, and the two largest subsectors are elementary/secondary schools and colleges, universities, and professional Schools, most likely heavily dominated by UMass Lowell as the largest public school in the area. This industry mix makes Greater Lowell a prime location for initiatives like LINC to have a high chance of success, providing a pipeline of

well-educated students moving up through primary school on through college, and many high-tech firms looking to hire said students in the area post-graduation.

Table 1: Top 10 Greater Lowell, 2023 and 2032

NAICS	Description	2023 Jobs	2032 Jobs	2023 - 2032 Change	2023 Employment Concentration	2032 Employment Concentration
90	Government	24,642	29,741	5,099	1.12	1.24
62	Health Care and Social Assistance	19,305	23,092	3,786	0.97	0.97
31	Manufacturing	19,081	19,455	374	1.62	1.50
54	Professional, Scientific, and Technical Services	15,546	17,944	2,399	1.44	1.40
44	Retail Trade	11,557	11,817	261	0.80	0.77
72	Accommodation and Food Services	10,538	12,394	1,855	0.83	0.86
81	Other Services (except Public Administration)	8,771	9,922	1,151	1.16	1.19
23	Construction	8,550	9,560	1,010	0.97	0.98
56	Administrative and Support and Waste Management and Remediation Services	8,398	9,206	809	0.91	0.89
48	Transportation and Warehousing	6,094	6,929	835	0.92	0.87

Source: Lightcast

Industry Breakdown

Government is the largest employer in the Greater Lowell area, with employment heavily concentrated in the education sector. Elementary and secondary schools run by local governments are the largest employers, followed by colleges and universities. These two sectors are expected to continue to grow significantly over the next ten years, reflecting the importance of education in the area. LINC is expected to accelerate this growth, with economic impact projections in this study indicating over 1,700 new jobs will be directly created by LINC at multiple employers in a range of industries, including in public education.

Table 2: Top 5 Government Industry Subsectors, 2023 and 2032

NAICS	Description	2023 Jobs	2032 Jobs	2023 - 2032 Change
903611	Elementary and Secondary Schools (Local Government)	8,252	10,038	1,786
902612	Colleges, Universities, and Professional Schools (State Government)	5,565	6,682	1,117
903999	Local Government, Excluding Education and Hospitals	5,317	6,644	1,327
901199	Federal Government, Civilian, Excluding Postal Service	2,221	2,499	278
902999	State Government, Excluding Education and Hospitals	2,166	2,736	570

Source: Lightcast

Manufacturing is a dominant industry in the Greater Lowell area, containing the third highest number of jobs, compared its place as the sixth highest industry in the state overall. Employment concentration in the industry is 50 percent higher than the national average, and manufacturing jobs in the area are specifically concentrated in advanced manufacturing.

Table 3: Top 5 Manufacturing

NAICS	Description	2023 Jobs	2032 Jobs	2023 - 2032 Change
334516	Analytical Laboratory Instrument Manufacturing	3,536	4,301	764
334112	Computer Storage Device Manufacturing	1,714	1,320	(394)
334513	Instruments and Related Products Manufacturing for Measuring, Displaying, and Controlling Industrial Process Variables	1,433	1,484	51
334511	Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing	1,099	707	(391)
334510	Electromedical and Electrotherapeutic Apparatus Manufacturing	981	1,263	282

Source: Lightcast

The upcoming facilities expansion as part of LINC is expected to build hundreds of thousands of square feet of new commercial space for companies looking to relocate near UMass Lowell. With more than half of UMass Lowell students enrolled in STEM programs, the new office space could provide opportunities to grow the local advanced manufacturing workforce by funneling students into local companies through internship programs.

In a statement as part of the announcement of LINC, UMass Lowell Chancellor, Julie Chen, specifically noted as an example that small companies who graduate from the school's "M2D2" medical device incubator space often struggle to find appropriate office locations, and that she envisions LINC as an opportunity to build on these existing efforts to keep startups in developing fields in the city.

Table 4: Top 5 Professional, Scientific, and Technical Services Industry Subsectors, 2023 and 2032

NAICS	Description	2023 Jobs	2032 Jobs	2023 - 2032 Change
541714	Research and Development in Biotechnology (except Nanobiotechnology)	3,232	4,313	1,081
541330	Engineering Services	2,440	2,819	380
541511	Custom Computer Programming Services	1,923	2,083	160
541715	Research and Development in the Physical, Engineering, and Life Sciences (except Nanotechnology and Biotechnology)	1,594	2,077	482
541512	Computer Systems Design Services	1,419	1,062	(357)

Source: Lightcast

The professional, scientific, and technical services industry, while slightly less dominant in Lowell than in the state overall, still employs people at a rate 40 percent higher than the national average. Similar to manufacturing, the dominant subsectors are high-tech and research oriented, specifically in biotech, engineering, and other sciences. The industries are also well-positioned to move into the new commercial space in LINC to take advantage of the large number of STEM students. The university already runs 110 Canal, a sustainability-focused incubator/accelerator that supports and nurtures startup businesses with a primary emphasis on clean energy, sustainable chemistry, environmental and other innovations, and this could serve as a feeder into the new commercial space in a similar way to how Chancellor Chen envisioned M2D2 leading advanced manufacturing companies into the space.

Table 5: Most Unique Job Postings By Company

Company	Latest 365 Days Unique Job Postings
University of Massachusetts Lowell	783
Tufts Medical Center	400
Tufts Medicine	385
Lowell General Hospital	344
Community Teamwork	307
Lowell Public Schools	259
Middlesex Community College	256
Lowell Community Health Center	213
UKG	194
City Of Lowell	194
TRC Environmental Company	187
Vinfen	172
Aramark	148
Amazon	137
Healthcare Employment Network	130

Source: Lightcast

UMass Lowell already posts the most new job openings in the Greater Lowell area, and this number is expected to grow with LINC. Outside of hospitals and education, most other large companies exist in the professional and consulting space, which could provide access to professional services to help start-ups attracted by the expansion efforts.

Current Initiatives to Support Innovation and Commercialization

UMass Lowell ranks as a Research II (also "R2") university, indicating "High Research Activity", and is one of the top research institutes in the country. It earned a number one ranking for a public university in the Wall Street Journal and currently maintains research contracts worth over $120 million. To continue UMass Lowell's rise as a premier research university, the City of Lowell and UMass are collaborating to allow the University to dramatically scale up research enterprise contracts, technological advancements, business activity, and collaborative interactions through Lowell Innovation Network Corridor. However, new labs and office space for collaborators is only part of the economic picture when determining LINC's potential impact on the economy. UMass and the City of Lowell envision LINC perpetuating the continued transformation of Lowell, with new housing, restaurants, retail, and entertainment venues to accompany the expected influx of workers and students.

LINC is expected to create jobs in Lowell across multiple industries and all levels of experience, expand industry partnerships and talent pipelines, create career opportunities and enhance UMass Lowell student recruitment, transform Lowell into a top destination for companies, students, researchers, families and visitors, and serve as an accelerator for innovation and growth across the region.

Industry Partnerships – Draper

The largest industry partner announced as part of the LINC project is Draper, a nonprofit engineering company that builds cutting edge defense, space, and biotechnology. Draper hopes to double its current 2,400-personstaff in the coming years and was attracted to Lowell by the existing talent pipeline, including not only UMass Lowell but also Middlesex Community College, the Lowell public school

system, and Greater Lowell Technical High School. Draper also cited UMass Lowell's success as a strategic partner to industry in the high-tech field, especially its top tier microelectronics program. The combination of Draper, UMass Lowell, and the presence of a cluster of regional tech businesses will help further cement Greater Lowell as an innovation hub.

Currently, UMass Lowell has robust engagements with industry partners comes through its Core Research Facility and New Venture Development. The UMass Lowell Core Research Facility (CRF) operates as a shared research equipment program, providing industry partners with access to over 100 advanced instruments and a team of highly trained technical staff. This resource is utilized by more than 200 companies, facilitating significant advancements in their research and development initiatives at a low cost, including vouchers for companies with less than 50 full-time employees. By offering access to machinery that can cost in the hundreds of thousands of dollars (or more), UMass Lowell makes it possible for innovators to make discoveries that can be patented and contribute to the growth of existing companies and new enterprises. The LINC initiative can be seen as an extension of this existing work and will help these innovators stay and expand in the Greater Lowell region.

The New Venture Development (NVD) initiative combines University resources and equity investment to facilitate and enhance startup activity at UMass Lowell. NVD assists teams in exploring and developing commercialization strategies, testing market assumptions, recruiting expertise and talent both within and outside the university, and securing early-stage funding. This initiative aims to accelerate early commercialization efforts and better prepare university-related startups for additional financing opportunities.

The foundation laid by these commercialization and innovation efforts has already grown into more direct relationships with large tech companies similar to Draper, including the Printed Electronics Research Collaborative (PERC), a strategic partnership between industry, university and government to establish a world-class Additive Manufacturing (AM) and Printed Electronics (PE) research center rooted in real world applications. It includes companies of all sizes, public and private universities, and U.S. Department of Defense and New England partners to strengthen and expand the region's capabilities in printed and flexible electronics.

Several manufacturing institutes have also spun out of these efforts, bolstering the already robust regional manufacturing industry. These include the Center for Advanced Manufacturing of Polymers and Soft Materials (AMPS) and the Fabric Discovery Center, both of which work with small businesses, startups, and large organizations. AMPS grew out of existing expertise in nanomanufacturing with the help of an award from the National Science Foundation, working in collaboration with Northeastern University and the University of New Hampshire. AMPS has continued to grow through funding from state and federal sources including the Massachusetts Technology Collaborative and the US Army, and partners with key companies in the Greater New England area that look to AMPS research to sustain the region's competitive edge the Nanomanufacturing Center Executive Advisory Board.

The Fabric Discovery Center works closely with local businesses at 110 Canal Street, offering high-tech equipment in the areas of Smart Fabrics and Textiles, Flexible Hybrid Electronics, Human-Robot Interaction, and Assistive and Sensing Technology to industry partners, faculty, and students. The Center also is professionally staffed to train future workers on advanced manufacturing equipment that creates next generation fabrics, and the training is able to be personalized to target various groups, from K-12 STEM students to Doctoral candidates, and connects trainees to regional companies searching for employees.

The proven track records of PERC, AMPS, and the Fabric Discovery Center bode well for the success of the LINC project, with PERC stating that the collaborative succeeded due to state of the art facilities on campus, leading research and development practitioners on campus, significant corporate and government partnerships in place, and the ability to work with students from relevant areas on campus, such as the Center for Advanced Manufacturing of Polymers and Soft Materials, the Plastics Engineering Department, and the Chemistry Department. These factors are very similar to the reasons cited by Draper for expanding to Lowell and suggest that the economic conditions on the ground will match Draper's expectations.

Industry Partnerships – Mass General Brigham

Another recently announced collaborator coming to the LINC project is Mass General Brigham, which together with UMass Lowell announced a new collaboration "to advance cognitive and decision-making performance for members of the military, law enforcement and security during stressful, complex situations".[67] The initiative is expected to have the opportunity to work closely with the existing HEROES (Harnessing Emerging Research Opportunities to Empower Soldiers) collaboration.

HEROES is a collaborative research and development center established by UMass Lowell and the U.S. Army Combat Capabilities Development Command Soldier Center (DEVCOM SC). The center focuses on advancing technologies for the protection, sustainability, and effectiveness of American soldiers. HEROES supports various projects by leveraging expertise from the University's colleges of sciences, engineering, health sciences, and management. This collaboration also engages with industry partners to impact the regional economy. Similar to the assistance offered by the Core Research Facility to help researchers commercialize scientific discoveries and inventions, HEROES focuses on transforming scientific discoveries into technological solutions for the military.

A secondary goal of HEROES is to serve as a knowledge hub, expanding research and development efforts to provide solutions for challenges faced by U.S. soldiers in the field. The Mass General Brigham project is well-positioned to slot directly into this endeavor, helping LINC quickly integrate into existing industry partnerships established by HEROES, potentially encouraging current HEROES industry partners to expand or relocate to LINC.

LINC in the Broader Economy

The creation of nearly 500 new units of housing for professionals as part of LINC will allow companies to locate where the talent is, rather than their workforce having to commute to Lowell. Not only would this save money on transportation costs and create positive environmental externalities, the presence of hundreds of new high wage workers living in the Acre would provide a huge boost to the local economy, creating new opportunities for local businesses and attracting new businesses to the area. Restaurants and entertainment venues would especially benefit from the increased foot traffic. Several officials also spoke of a "brain drain" that happens in Lowell, where the highly skilled workers produced by UMass Lowell's education pipeline leave due to a lack of affordable housing. Housing has become a serious business climate issue in Massachusetts and is seen as a threat to the state's competitiveness. Although Lowell is relatively affordable compared to communities closer to the urban core (and can still provide a more affordable housing option), it is still expensive compared to many other markets in the country.

[67] Rollins, Bec. "UMass Lowell, Mass General Brigham Collaborate to Advance Human Performance, Expand LINC." UMass Lowell News. July 17, 2024. https://www.uml.edu/myuml/submissions/2024/2024-07-16-13-17-35-umass-lowell-mass-general-brigham.aspx.

Having well-paying jobs combined with housing in the LINC area for new graduates can create a hub of entrepreneurial young professionals, sparking new business ideas and economic development similar to places like Kendall Square in Cambridge that benefit from so many large innovative companies sharing a common workspace. This type of dynamic fomented by LINC can also serve to keep talent in the Greater Lowell region, ultimately benefiting the Massachusetts technology ecosystem.

The increased housing and economic activity will not only attract new workers but could also attract highly skilled workers in the area to move back to or spend more time in Lowell. As mentioned in the previous section, Greater Lowell has a high concentration of companies that would be a good fit for LINC, including tens of thousands of workers in biotech and engineering R&D, precision instrument and electromedical device manufacturing, and higher education. These workers present a ready-built workforce for the current companies that support LINC, which exist in such sectors as biotech and biomedical devices, robotics, electronics, sensors, climate-tech, space technology, cybersecurity, artificial intelligence and human performance, and the new office space created by LINC will provide them with a ready-built space to grow in. Additionally, Greater Lowell-area companies that are not currently involved with LINC may wish to be closer to the action around the Acre as it develops, and move from outlying towns into LINC to get better access to new graduates and UMass Lowell facilities, potentially spurring even more construction and development if the commercial space built during phases one and two of LINC fill up.

LINC will also support currently existing commercialization efforts by providing office space for new companies and their products that emerge out of the Core Research Facilities or other projects like PERC. Companies that currently use CRF labs or services are familiar with the area and would also be prime tenants for the new commercial buildings being created as part of LINC if the currently pledged companies are not enough to fill the available office spaces, allowing the private developers who are funding more than three-quarters of the project to quickly make good on their investment.

This increase in activity and retention of talent will help not only Lowell and the surrounding area, but also provide a boon to the state overall. Getting young people to start their career in Massachusetts can set them on a career pathway to remain in the state long term, maintaining Massachusetts' strategic advantage in high tech industries.

LINC Economic Ecosystem: Conclusion

LINC complements and positions Lowell as an attractive alternative to the Boston-Cambridge area, capitalizing on its proximity to both Boston and the suburbs from which Boston workers commute, as well as lower living costs. Greater Lowell's industry strengths—especially in manufacturing and professional, scientific, and technical services—make it a prime location for innovation-driven initiatives. The region's strong advanced manufacturing sector, particularly in precision instruments, defense-related industries, and medical equipment, synergizes with a professional services sector that is heavily focused on R&D, engineering, and biotech, positioning the area to support the kinds of innovative companies UMass Lowell seeks to nourish and attract through LINC. With a strong pipeline of well-educated STEM students from UMass Lowell and other nearby colleges and universities, the region is well-suited to support workforce development and local job growth.

UMass Lowell's existing STEM programs and incubators provide an initial roadmap for LINC to follow and bring to the next level, helping to retain and scale-up startups in the region, facilitating partnerships with local companies, and further strengthening the area's economic foundation. UMass Lowell is

designated as an RII research university and is on the path to becoming an RI research university. These designations enhance UMass Lowell's ability to drive innovation through partnerships and commercialization efforts, boosting LINC's opportunities to attract industry partners, create jobs across sectors, and foster local economic growth by developing new labs, office space, and community amenities. Major partners like Draper and Mass General Brigham were drawn to the region's talent pool and research capabilities, and these collaborations will further position Greater Lowell as a hub for innovation. The opportunities that UMass Lowell already provides to local industry, particularly through the Core Research Facilities and research centers like PERC, AMPS, and the Fabric Discovery Center have already strengthened regional industries, particularly in advanced manufacturing and nanotechnology. LINC can build on these successes, and the new collaboration with Mass General Brigham coming to LINC already plans to integrate with the pre-existing HEROES initiative, highlighting LINC's potential to integrate and broaden the existing research ecosystem.

The creation of hundreds of new housing units geared towards professionals as part of LINC is expected to enhance Lowell's attractiveness to companies by allowing talent to live in proximity to their workplaces, both reducing commuting costs and environmental impacts. This potential influx of high-wage workers would provide a significant boost to the local economy, benefiting small businesses like restaurants and entertainment venues, while retaining workers and addressing "brain drain" issues. The availability of affordable housing paired with well-paying jobs can help retain UMass Lowell graduates and attract entrepreneurial talent, fostering a vibrant professional and business agglomeration of activity similar to Cambridge's Kendall Square.

As the LINC area develops, it is poised to attract highly skilled workers from industries such as biotech, robotics, and advanced manufacturing, further integrating with the region's existing strengths. The new office and innovation spaces will not only house current industry partners but also draw companies looking to innovate and expand, driving additional development. Moreover, LINC will provide much-needed space for startups emerging from UMass Lowell's research initiatives, supporting commercialization efforts and further boosting economic activity. Ultimately, the increased housing and professional opportunities will strengthen Greater Lowell's innovation ecosystem, which has been cultivated since the city's founding, helping retain talent in Massachusetts and reinforcing the state's leadership in high-tech industries.

Economic Impact Analysis

As a major institution that employs thousands of workers, educates students, builds facilities, and purchases products, UMass Lowell has a major impact on the state and surrounding economy. This analysis focuses on quantifying the potential economic benefits of the Lowell Innovation Network Corridor (LINC).

The economic activity of LINC encourages other businesses to cluster near the school and will enable them to grow and contribute to the Massachusetts economy. UMass Lowell acts as an anchor institution and promotes economic activity in other industries besides higher education, notably supporting innovation and business formation in the Massachusetts scientific and technical economy.

This analysis does not include benefits from visitors to the new campus or benefits from spin offs of the University such as start-ups. The impact analysis software used for this analysis is only able to extrapolate impact based on known inputs to the LINC project. Upon completion of the project, induced demand driven by LINC may produce larger economic impacts as businesses and residents orient themselves to better access to the opportunities provided by LINC.

Methodology

The UMass Donahue Institute (UMDI) Economic and Public Policy Research Group (EPPR) estimated the economic impacts of the Lowell Innovation Network Corridor development using the IMPLAN econometric model with inputs provided by UMass Lowell.

The approach involves quantifying impacts under two key concepts:

- Construction and Operations Impacts
- Economic Impacts of Occupants/Tenants in LINC Buildings

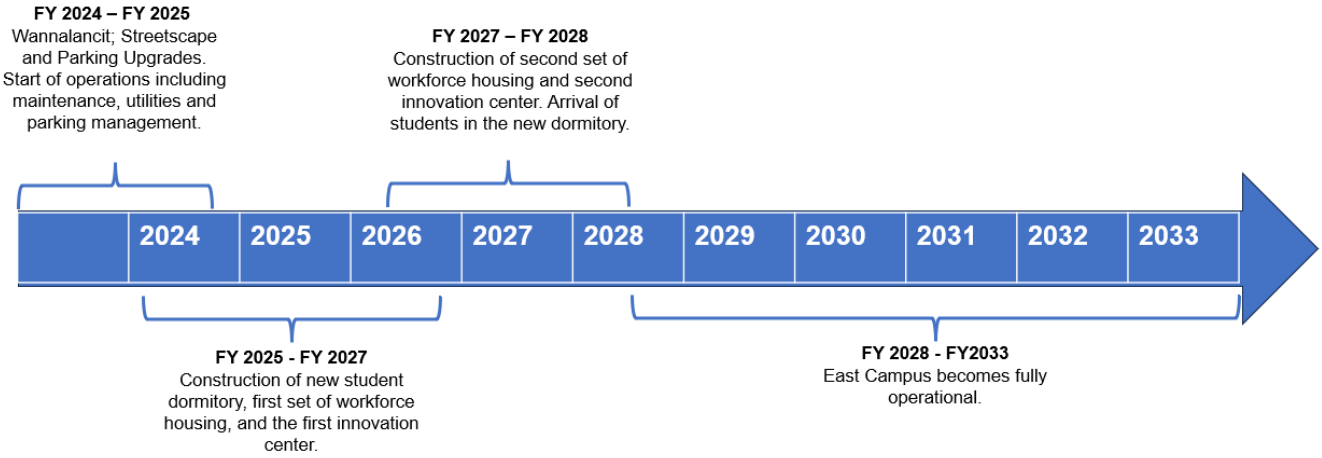
Data was received on:

- Construction and fit-out costs for all buildings
- Operations spending
- Detailed student spending (tuition, books, personal expenses)
- Workforce housing predicted rents and occupancy
- Square footage by use of space expected to be occupied

Data included the timing of these activities across the ten-year period. This information was transformed into inputs for the economic model, activity for each part of the process was assigned to an industry and inputs were distributed over the ten-year period. The geography of the impact analysis was set as the state of Massachusetts. The impact analysis is based on the initial plan of the project, which may change.

Timeline

Figure 6**: Timeline of LINC**



Note: Timeline is as of the date that the impact analysis was created and subject to change.

The Lowell Innovation Network Corridor is divided into separate phases. The timeline presented in **Figure 6** represents the project as initially scoped and the timeline around which this analysis was based. This timeline may change as the project progresses.

The Lowell Innovation Network Corridor website simplifies the timeline into three phases. The initial work (Phase zero) is focused on enhancements to Wannalancit and related infrastructure. This phase will include moving new employers into the mill such as Draper, which has already moved 50 employees into Wannalancit from their Cambridge offices. These employees work in Draper's microelectronics division. Draper is planning to expand their employee presence as more space becomes available.

Phases one and two of the project will include the construction of an industry-focused building that will give private employers access to campus resources including faculty and student workers. This phase will include nearly 500 units of housing intended for young professionals. Phases one and two are set to begin in 2025 and to be occupied by 2027.

The third phase of the project will add over 450 beds of student housing to the project. Each phase will require investments in infrastructure, particularly improvements to the roads and bridges that connect LINC with the city, which will have positive economic impacts on the city and campus.

Impact Analysis: Benefits of the Lowell Innovation Network Corridor

Public and private investment in development to construct and operate LINC will have positive economic impacts on the economy of Lowell and the rest of the Commonwealth. Economic impact in this report is divided into direct, indirect, and induced effects which can be summed together to produce a total economic impact.

- **Direct effects** refer to the investment enabling the construction, fit-out and operation of LINC.

- **Indirect effects** are generated by intermediate purchases for goods or services that support activities occurring in LINC during its construction, fit out and operation. Payments made to architectural contractors, consulting firms for professional and business services, and vendors of construction materials and equipment are examples of indirect effects of spending on LINC.

- **Induced effects** occur when income is spent on household-related goods and services. Employee payroll, resident spending, and student spending are an important part of the analysis of LINC.

The following sections will break down the economic impact of LINC into various components, starting with the overall economic impact of all LINC-related activities.

Overall Economic Impacts

The Lowell Innovation Network Corridor is expected to support over 2,000 new jobs on average per year across the ten-year 2024-2033 period (equivalent to 20,000 worker-years of employment). This project will generate a total output of over $3.7 billion in economic activity across the Commonwealth between 2024 and 2033.

Table 6: Total Impact on Employment and Output by Year, FY2024 - FY2033

Total Impt	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Employmen	805	2,360	1,970	3,051	3,554	1,699	1,700	1,700	1,700	1,700
Output (In thousands)	$129,317	$376,022	$310,231	$487,099	$665,569	$357,071	$357,100	$357,130	$357,149	$357,167

The highest predicted total output and employment will be in FY2027 and FY2028 as seen in **Table 6**. This period combines the end of phase one of construction, the construction of the second phase, operations, and student spending. Construction completes at the end of FY2028 and the annual employment impact after construction completion is estimated at 1,700 persons per year.

Table 7: Summary Economic Impacts, FY2024 - FY2033

Impact	Employment	Labor Income	Value Added	Output
1 - Direct	11,868	$1,159,092,437	$1,379,756,768	$1,946,518,337
2 - Indirect	2,299	$221,462,815	$335,931,184	$573,905,609
3 - Induced	6,073	$462,655,297	$784,311,176	$1,233,431,451
Total	20,240	$1,843,210,549	$2,499,999,128	$3,753,855,398

Table 6 reflects the sum of the Direct, Indirect and Induced Impacts for employment and output across the 10-year study period. **Table 7** breaks out the various kinds of impact and adds details on labor income and value added. Summed together, the LINC project will generate over $1.8 billion in labor income and add $2.5 billion to the state economy across the period. Any expansions to LINC that will accommodate larger employers including Draper, will generate even greater economic impact.

Overall Construction Impacts

The previous impact analysis reflects the sum of all activities related to the LINC Project. The construction activities make up a substantial portion of these overall impacts. While construction will

only occur for a portion of the study period, it will produce the equivalent of over 9,000 jobs. Construction was estimated to occur between FY2024 and FY2028.

Table 8: Summary Construction Impacts, FY2024 - FY2028

Impact	Employment	Labor Income	Value Added	Output
1 - Direct	6,046	$537,044,159	$588,540,199	$814,295,402
2 - Indirect	660	$61,394,256	$95,912,727	$168,983,507
3 - Induced	2,515	$191,606,299	$324,607,274	$510,506,908
Total	9,222	$790,044,714	$1,009,060,200	$1,493,785,817

Construction produces substantial induced impacts as workers and consultants, hired to build LINC spend their salaries across the Commonwealth.

Overall Operations Impacts

As construction and renovation is completed in LINC, there will be a considerable amount of operations spending to maintain the growing facilities. The impacts of this activity are described below in **Table 9**. Operations related activities were estimated to begin in FY2025.

Table 9: Summary Operations Impacts, FY2025 - FY2033

Impact	Employment	Labor Income	Value Added	Output
1 - Direct	1,346	$87,387,586	$105,306,032	$136,523,449
2 - Indirect	151	$10,336,131	$18,635,571	$35,655,137
3 - Induced	402	$30,637,032	$51,969,062	$81,745,016
Total	1,898	$128,360,749	$175,910,665	$253,923,602

Overall Tax Impacts

Economic activity generates taxes which can be modelled. IMPLAN divides its analysis of taxation by type of tax. The analysis estimates:

- Sales tax (including meals and occupancy taxes), property tax and income tax.
- Fees for certain activities such as business licensing and vehicle registration
- Many other forms of tax/fee including excise taxes, tolls, and employee/employer contributions to government programs.

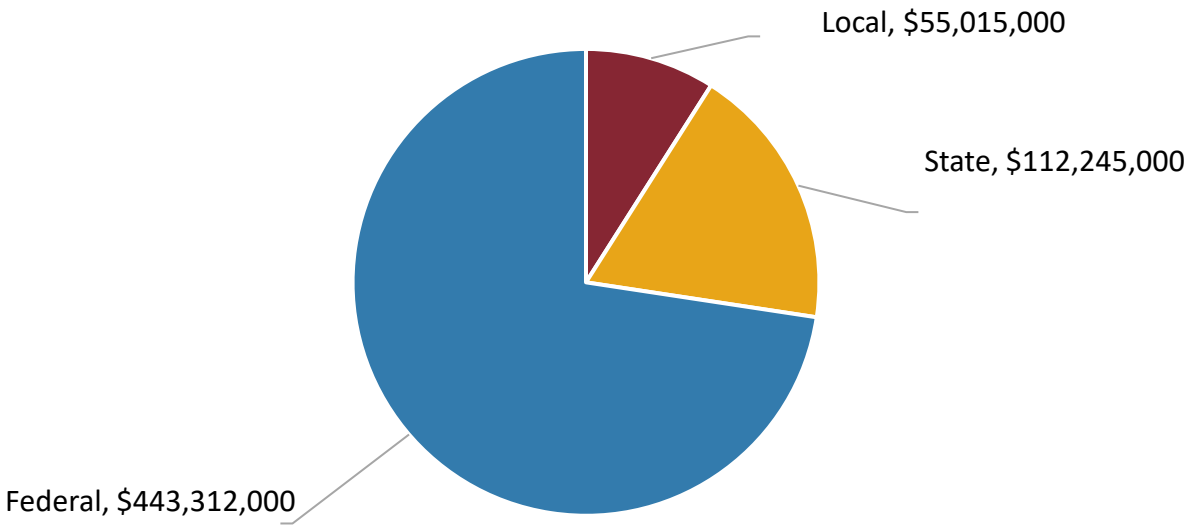
Each tax and fee is summed to the appropriate government level: local, state or federal. Following the trend with output, tax impacts are highest in FY2027 and FY2028. On average there will be $17 million in state and local tax impacts annually.

Table 10: Tax Impact by Region, in Thousand of Dollars, FY2024 - FY2033

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Local	$1,725	$5,144	$4,120	$6,522	$9,449	$5,609	$5,610	$5,611	$5,612	$5,613
State	$3,956	$11,467	$9,415	$14,583	$19,674	$10,628	$10,629	$10,630	$10,631	$10,632
State and Local Subtotal	$5,682	$16,610	$13,535	$21,105	$29,124	$16,237	$16,239	$16,242	$16,243	$16,245
Federal	$16,355	$47,039	$39,029	$59,860	$78,521	$40,496	$40,499	$40,502	$40,504	$40,507
Total	$22,037	$63,649	$52,563	$80,966	$107,645	$56,733	$56,738	$56,744	$56,748	$56,752

Summed together, the LINC project will produce a tax impact of nearly $170 million for state and local governments as shown below in **Figure 7**.

Figure 7: Cumulative Taxes, FY2024 - FY2023



The LINC project will generate substantial tax revenue. For example, workers, faculty and staff will spend money at restaurants and stores in and around LINC, generating meals tax locally. Improvements to Lowell as part of LINC will make visitors spend more time in Lowell's Downtown and Acre neighborhoods, creating further tax impacts.

Economic Impacts by Tenant Type

Inputs for the impact analysis were detailed enough to estimate the impacts of the distinct groups that will make up LINC. Those groups include:

- Student Impacts
- Young Professional Resident Impacts
- Faculty and Staff Impacts
- Business Impacts

Each group was modelled in a slightly different way. The first group, representing students, has an economic impact on the city and Commonwealth through student spending on tuition, housing, school materials, transportation, and living/personal expenses.

The impact of these activities, direct, indirect, and induced are summarized below in **Table 11**.

Table 11: Student Impacts, FY2024 - FY2033

Impact	Employment	Labor Income	Value Added	Output
Total	1,657	$108,786,000	$149,780,018	$218,556,435

Student spending is modelled on the typical spending of students drawn from federal surveys of college and university attendees. The model assumes that students will not occupy LINC until year four at the earliest.

The LINC project will incorporate residential housing, and that housing will be targeted at young professionals, particularly those employed by LINC businesses. It is likely that these residents will be highly paid, in fields such as engineering, and their incomes will partially be spent locally. These professionals will also pay rents and the estimated rents for the new residential units can be estimated. The residential units were estimated to become occupied in FY2027 and a five percent vacancy rate was assumed. It was also assumed that each housing unit would have one salary earner. Based on this information, the estimated rents for the residential building, and assuming 20 percent of salaries by residents would be spent locally, the impacts of these new young professionals can be estimated as shown in **Table 12.**

Table 12: Young Professional Resident Impacts, FY2024 - FY2033

Impact	Employment	Labor Income	Value Added	Output
Total	493	$33,180,944	$120,953,565	$151,504,618

Partnerships with entities like Draper, Mass General Brigham Hospital and other businesses in LINC will provide research opportunities for faculty, staff, and students. Combined with improvements to urban amenities and housing, the LINC project will improve campus competitiveness and attraction for faculty, staff, and students from around the world. The development of LINC may also attract K-12 and community college students who are looking for future opportunities. Jobs at LINC would include positions for entry level as well as specialized personnel making it a launch pad for new careers and a desirable location for more experienced workers. It is difficult to know for sure how many new staff this

project might attract based on available inputs so the impact on faculty and staff was not quantified for this report. But they are likely to have a substantial impact.

Finally, data was available on the proposed size of various commercial spaces in LINC, including retail space, restaurants, office space, and laboratories. These sizes were then compared to measurements of employment per square foot provided by the U.S. Energy Information Administration. For example, the median professional office in the US provides approximately 609 square feet per worker. Using the square footage estimate, an employment estimate can then be created, and its impact calculated.

Table 13: Business Impacts, FY2024 - FY2033

Impact	Employment	Labor Income	Value Added	Output
Total	6,969	$782,838,142	$1,044,294,679	$1,636,084,925

The total impact of proposed commercial businesses in LINC are defined in **Table 13** above. Businesses were estimated to begin operations in FY2028 of the study period. The combined business activity of LINC is substantial and there will be further impacts as residents, students, and visitors of LINC engage with surrounding neighborhoods including the Acre and Downtown. The amount of activity in those adjacent areas could not be modelled in this analysis.

Further Growth

This analysis was performed using the initial set of predicted inputs for the project which are subject to change as the needs of employers and the campus evolve. There are two areas in which this analysis may understate the impact of the project overall.

Expanded Development

The preceding economic analysis was based on the initial scoping of the LINC project. These plans are subject to change. Any additional floor space will allow for more employment or more student residents in LINC. More activity in LINC unlocks more spending and tax revenue locally. Any additional construction would also mean more construction impacts. Expansions to the LINC project could allow for more businesses to co-locate near the UMass Lowell campus and other employers.

Employer Interest in LINC

UMass Lowell is working with the city, the campus, and employers to help shape LINC and make it compatible with their developmental, employment and research needs. Employers continue to join the project, potentially unlocking even more economic opportunities and a greater impact.

Draper, a major non-profit engineering innovation company, has taken an interest in LINC, bringing as many as 700 direct jobs to Lowell. The company specializes in strategic systems, national security, space, and biotechnology. Expansions to the innovation center will better accommodate major research entities like Draper. As of this writing, the company has moved 50 employees from their Cambridge office to the LINC project, leasing office space in the existing Wannalancit mill complex.

The presence of a company like Draper will have a major positive effect on the economic impact of LINC and would only be partially captured by the current analysis which was performed prior to Draper's

expansion announcement to the Lowell Innovation Network Corridor. Depending on how many employees Draper ends up bringing in, the estimates of employment in engineering and research capacities in LINC would be revised upwards. Draper's highly educated and well-compensated employees would have a strong economic impact on the campus, city, and region. The presence of an internationally recognized research outfit like Draper has the strong potential to attract other companies as well as generate new spin-offs that would expand and be headquartered in the region. Draper can act like an anchor tenant around which other companies can feel confident that they can establish themselves.

New research avenues are already being opened up through LINC. In July 2024, a partnership between UMass Lowell and Massachusetts General Brigham was announced. UMass and Mass General will develop training materials for law enforcement, the military and emergency services. This work will leverage campus and Mass General Brigham research into kinesiology, exercise physiology, neuroscience, and life sciences. The partnership will connect with the UMass HEROES program, empowering research in that existing program.

As more employers join the project, the potential of LINC becomes amplified, and the overall economic impact will likely be significantly greater than what is predicted in this report.

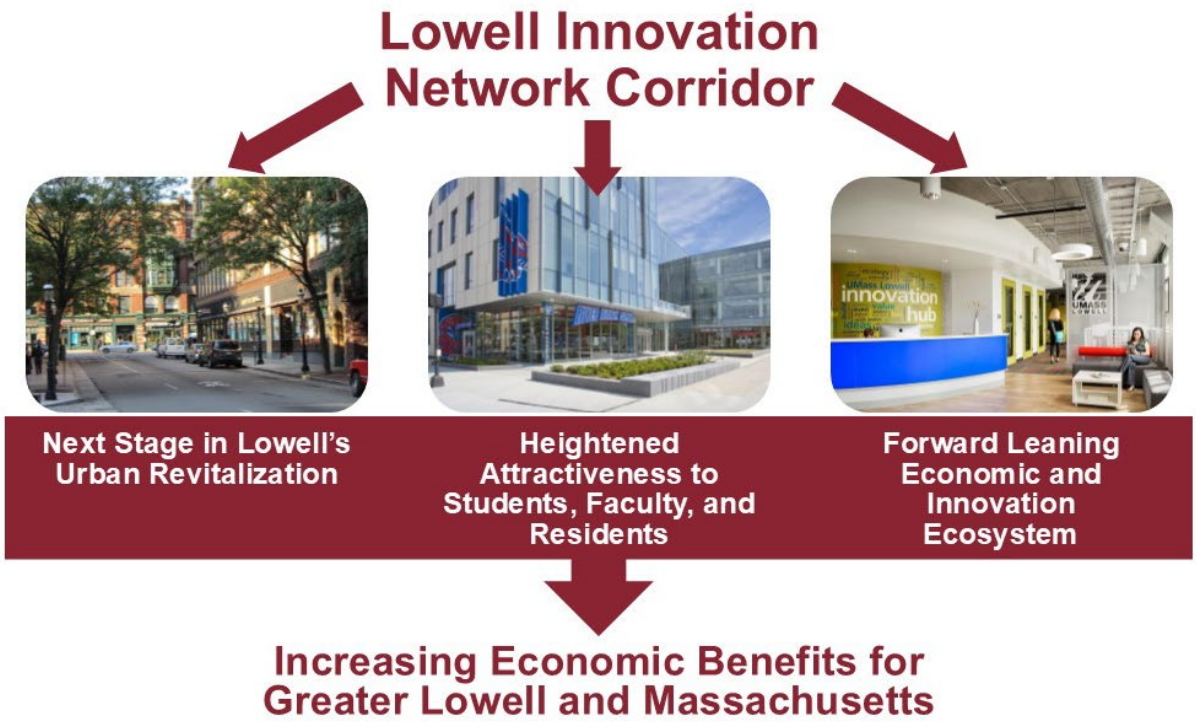
LINC Economic Impact Analysis: Conclusion

The Lowell Innovation Network Corridor is an investment in every facet of Lowell. LINC improves public campus facilities while also drawing in private employees. It improves the urban fabric of Lowell through investments in infrastructure and commercial real estate. Based on the planned inputs for the project alone, LINC is expected to have a large economic impact, but it is likely that as the project develops, more employers and more economic activity will be drawn into Lowell.

The Lowell Innovation Network Corridor is expected to support over 2,000 new jobs on average per year across the ten-year 2024-2033 period (Equivalent to 20,000 worker-years of employment). This project will generate cumulatively a total output of over $3.7 billion in economic activity across the Commonwealth between 2024 and 2033. Any expansion in the scope of the LINC project which would accommodate larger employers including Draper will generate even greater economic impact.

LINC is a major investment in the future of the City of Lowell and in UMass Lowell’s capabilities. LINC will have positive economic impacts on both the city and the rest of the state for decades to come.

Executive Conclusion



The Lowell Innovation Network Corridor represents a generational opportunity for UMass Lowell, the City of Lowell, and the Greater Lowell economy, as illustrated in the diagram above. The project builds upon recognized academic, community, innovation, and business assets already present in the region and takes them all to the next level by fostering urban revitalization, leadership in the research and development of breakthrough solutions and technologies, and an ecosystem bringing together workers and businesses in close proximity. This combination of enhancements, additionally, will bolster UMass Lowell's existing strengths and raise its competitive edge for recruiting and retaining students, faculty, and staff. The economic benefits that result from the concentration of businesses and people in LINC will continue to accrue and gain momentum in future years, yielding growth and opportunity for both Greater Lowell and Massachusetts as a whole. Beyond the immediate region, the business and research activities taking place at LINC will have progressively higher levels of impact as they are assimilated and put into practice by industries, both in the United States and throughout the world.

Appendix A: Lowell's Economic Development Prior to the 1970's

Lowell has transformed many times. Prior to European colonization the area was home to Native Americans, most prominently the Pennacook, for many generations. The Pennacook lived in the settlements of Pawtucket and Wamesit[68], benefiting from access to abundant fish, fertile land, and game in the area of what is now called Lowell. The King Phillip's war, an uprising of the Wampanoag against English settlers coincided with acts of violence by other European settlers against the Pennacook, many of whom had been confined to a reservation. Many Native Americans in the area were forced from their land and driven northwards into New Hampshire and Canada.[69] The Pennacook worked the lands in and around Lowell, and their descendants continue to live in Massachusetts and throughout New England.

The Establishment of the Mills

In the early 1800s, drawn to an abundance of low-cost hydropower on the Merrimack River, and a network of canals to transport goods, mills began to be built in and around what is now Lowell. It was an unprecedented level of industrial development. Richard Howe, Registrar of Deeds for Middlesex County, and author of several books on the city[70] and its history emphasized the uniqueness of Lowell at the time: "There was nothing like it in America. There had been smaller scale textile manufacturing, but this was the first place that brought everything, huge amounts of capital, skilled management, labor altogether in one place…". Incorporated as a town in 1826, Lowell's population grew quickly and was reincorporated as a city just ten years later. The mills attracted immigrant workers, primarily from different parts of Europe and French Canada but over time immigrants from many other parts of the world came to the city. Throughout this period of rapid growth, businesses in Lowell showed incredible ingenuity, adapting English manufacturing technologies and practices into an American context. An example of this ability to innovate occurred in the 1830s, when a local machine shop reverse engineered a British locomotive design, creating 75 locomotives for New England railroads[71]. Richard Howe refers to Lowell as the: "Silicon Valley of nineteenth century America" as businesses and workers in the city rapidly adapted to changing times and the city became a pioneer in American industry.

By the Civil War, Lowell was experiencing a slowing of its economic growth though it remained an economic powerhouse. Lowell benefitted from the 32-foot drop in the Merrimack River, which provided immense hydropower. But the city is inland, far from coastal shipping routes, making transportation costs high, Richard Howe explained how this led to Lowell falling behind: "…by the Civil War you had steam power becoming economically viable. And so, you'd have places like Fall River and New Bedford, which were on the seacoast, and they could make cloth more cheaply than they could in Lowell.".

[68] The UMass Lowell Office of Multicultural Affairs: https://www.uml.edu/student-services/multicultural/about-us/land-acknowledgement.aspx

[69] Lowell Historical Society: https://www.lowellhistoricalsociety.org/timeline/

[70] Richard publishes a blog covering the history and politics of the city: https://richardhowe.com/richard-howe/

[71] Details from a Lowell Historical Marker on the Locomotive industry in Lowell: https://www.hmdb.org/m.asp?m=117775

Economic Downturn

The city continued to grow though not as rapidly as it had in the first half of the 19th century and technological gains resulted in increased productivity at the cost of declines in employment[72]. The Lowell Normal School was founded in 1894, an all-women institution for educating teachers. A year later, the Lowell Textile School was founded. These two institutions were the predecessors of UMass Lowell. In the 1920's Lowell reached a population peak which it would not reach again for nearly 100 more years.

Richard Howe noted that it was around the 1920's that Lowell led the nation in experiencing an economic downturn: "We have this saying that the Great Depression came early and stayed late in Lowell". The city experienced a severe economic downturn, which persisted after World War II well into the 1970's as reflected in the population of the city shown above in **Figure 2** (See **Lowell Reinvention**). Lowell's population would not return to 1920 levels until the 2010s[73]. In the 1950s, the Boott and Merrimack mill closures put the city at an economic low point. In response to these economic challenges, a program of urban renewal was undertaken in the 1960s using federal funds. The stated goal was to revitalize the city through eminent domain and redevelopment of key areas of the city. This redevelopment would hopefully bring jobs and opportunity back to the city. In practice, urban renewal, occurring in Lowell, Boston, and many other cities around the country at that time resulted in major displacement of existing residents with little economic benefit. In Lowell, the neighborhood of Little Canada, which is now the site of UMass Lowell's East Campus and of LINC had been home to French Canadian workers and their families.

[72] Lowell National Historical Park, Decline and Recovery: https://www.nps.gov/articles/lowell-handbook-decline-and-recovery.htm

[73] Lowell's large immigrant population means that this population may be undercounted.

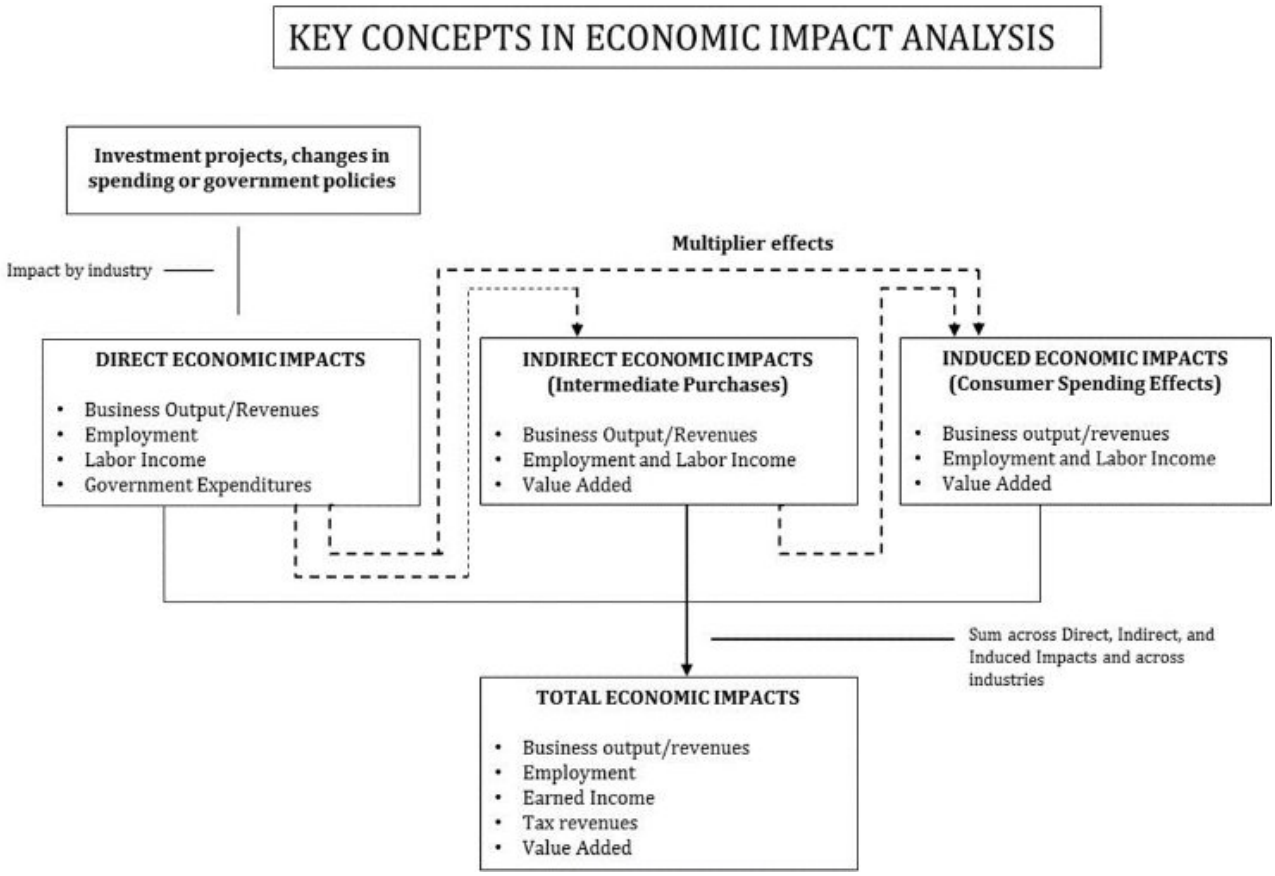
Appendix B: An Overview of Economic Impact Analysis

Economic Contribution Analysis

Economic contribution (or impact) analysis is based on the idea that a dollar spent in one sector of a region's economy (e.g., in construction) spurs economic activity in other sectors as the money is re-spent within the region. The economic impact on business output, employment, earned income, and tax revenue in the region is greater than the initial dollar spent.

In a general sense, the goal of "economic contribution analysis" is to estimate the total contribution of an organization or projects various economic-generating activities to a regional or state economy (e.g., Massachusetts). The basic premise is that an initial investment in one sector of an economy (e.g., in construction of a building) spurs additional economic activity in other sectors as the money is re-spent within the region or state. The total economic contribution of the investment is estimated by tracing the flow and recirculating of money between industries and households until all the initial investment eventually leaves the region or state through foreign or domestic trade or is collected as a tax.

Figure 8**. Economic Impact Analysis Explained**



The IMPLAN Model

The tool used for economic impact analysis in this project is the input-output model, IMPLAN. Input-output models, such as the IMPLAN model, examine the flow of money between industries and

households in the economy. The UMass Donahue Institute built an input-output model using the standard IMPLAN model. The data used in the model is for 2022, which are the latest available. Model outputs are reported in current dollars.

The IMPLAN modeling system combines the U.S. Bureau of Economic Analysis' Input-Output Benchmarks with regional employment and wage data to construct quantitative models of the flow of goods and services between a region's businesses and households (the final consumers), and estimates direct, indirect, and induced effects of investments and ongoing economic activity. From these data, one can examine the effects of a change in one or several economic activities to estimate its effect on a specific state, regional, or local economy. The IMPLAN input-output accounts capture all monetary market transactions for consumption in a given period. They are also based on industry survey data collected periodically by the U.S. Bureau of Economic Analysis and follow a balanced account format recommended by the United Nations. IMPLAN's proprietary database details economic activity across hundreds of industry sectors, as well as "institutions" such as local, state, and federal government and household spending. IMPLAN models reflect the most reliable and up-to-date knowledge about local spending patterns.

The total economic contribution of LINC as estimated by the IMPLAN model is the sum of direct, indirect, and induced effects of operating expenditures, construction expenditures, and employee and student spending. An explanation of each of those effects can be found in the section titled **Impact Analysis: Benefits of the Lowell Innovation Network Corridor**.

The IMPLAN software and data package for Massachusetts are used to model the later rounds of local spending that follow. The model is specifically tailored to reflect the expenditure patterns and industry mix of Massachusetts, including information about when expenditures leave the state due to foreign and domestic trade and taxes. Finally, all rounds of spending are added together to produce the total contribution estimate.

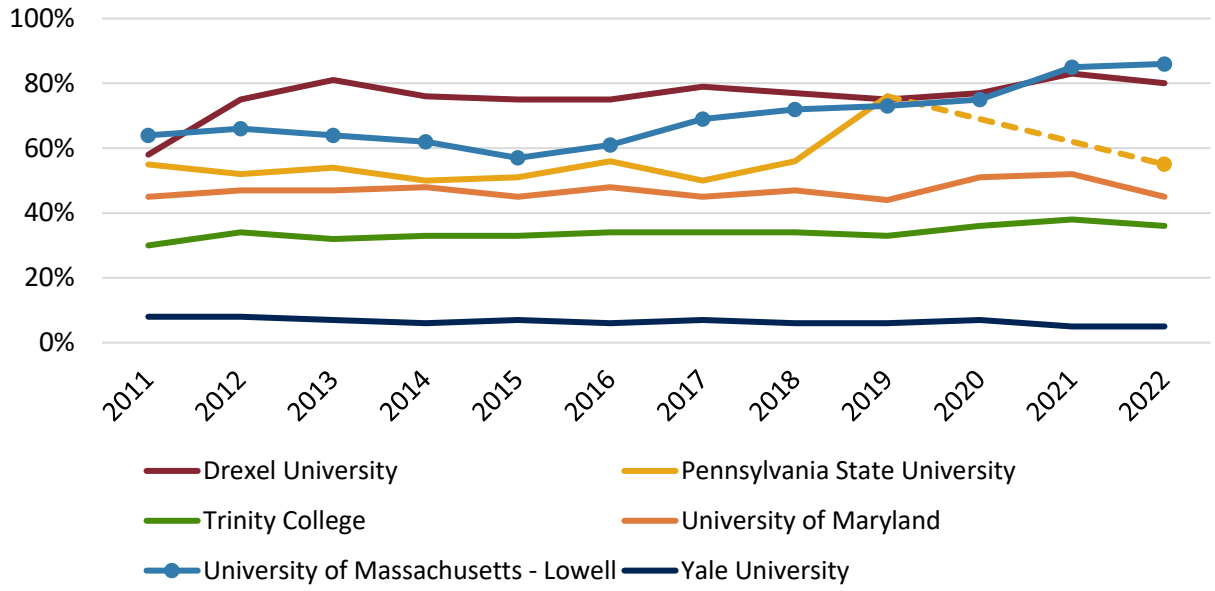
This analysis reports on two major types of economic contributions that are estimated by the IMPLAN model:

- **Output** refers to expenditures of the industry and supplier industries to produce the final good.
- **Employment** refers to all employees required to produce the outputs, including wage and salary employees, full-time and part-time employees, and the self-employed.

Appendix C: Student Attraction and Retention

Integrated Postsecondary Education Data System (IPEDS) data on admission rates, enrollment levels, retention rates, top programs, and graduation rates for selected case study universities and UMass Lowell.

Figure 9: Admission Rate for select Colleges and Universities, 2012-2022



Note: Data on Penn State was unavailable for 2020 and 2021

Figure 10: Enrollment for select Colleges and Universities, 2012 and 2022

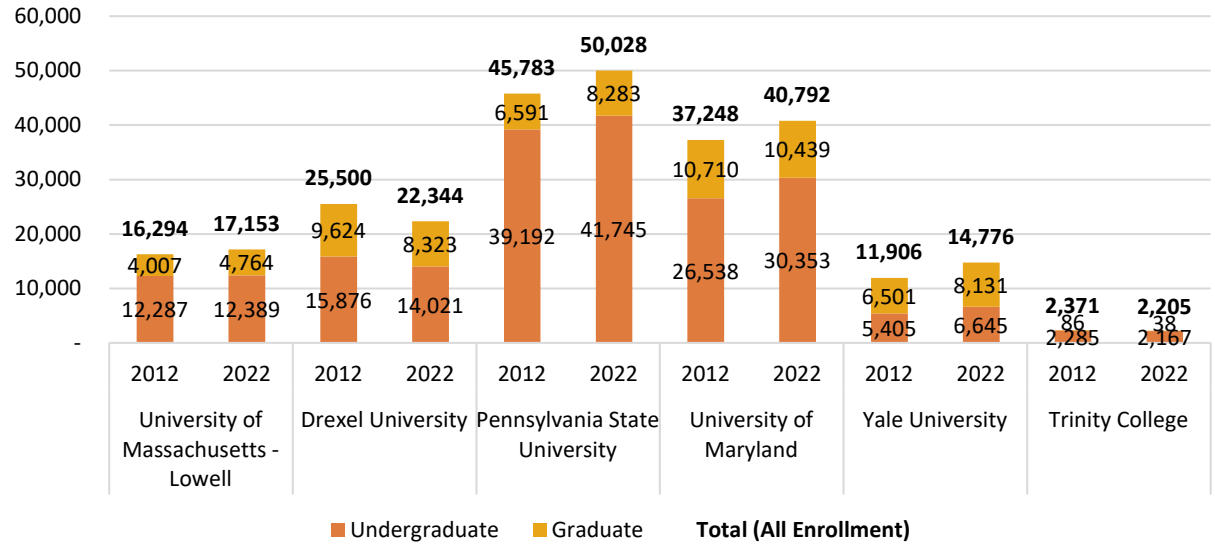
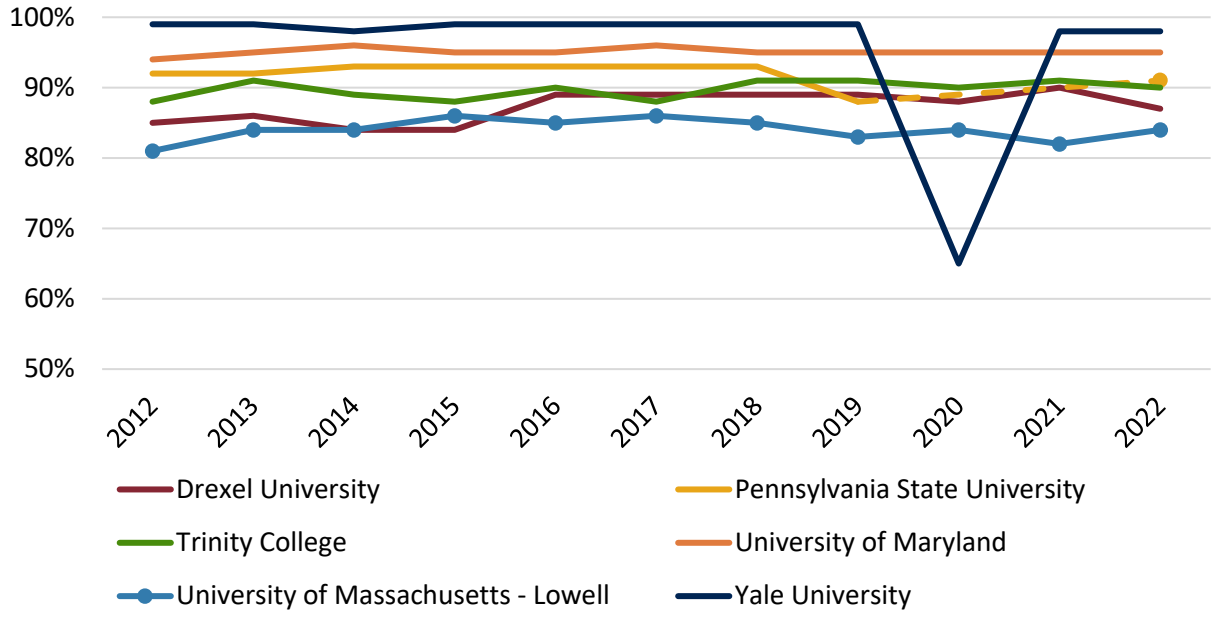
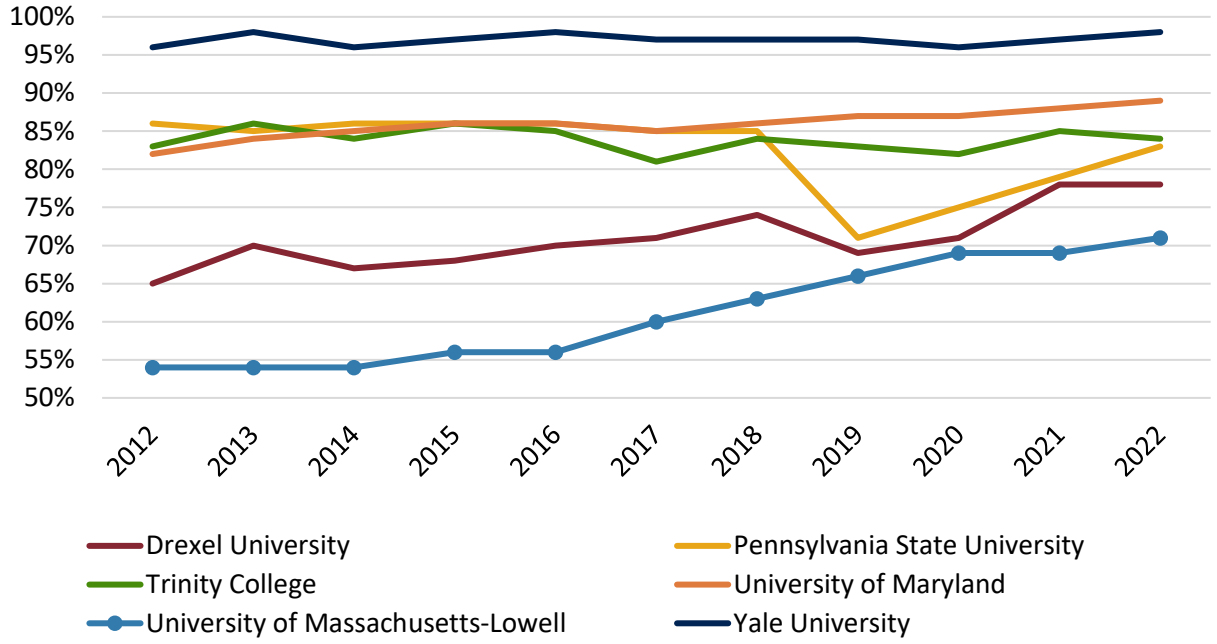


Figure 11: Retention rates for full-time students for select Colleges and Universities, 2012-2022



Note: Data on Penn State was unavailable for 2020 and 2021

Figure 12: Overall Graduation rates for select Colleges and Universities, 2012-2022



Note: Data on Penn State was unavailable for 2020 and 2021

Table 14: Degrees awarded in Top Programs at select Colleges and Universities, 2022

University/Program	Rank	Degrees Awarded	Total Degrees	Share of Total Degrees
University of Massachusetts - Lowell				
Business Management, Marketing, and Related Support Services	1	1,241	4,847	26%
Engineering	2	913	4,847	19%
Computer and Information Sciences and Support Services	3	477	4,847	10%
Trinity College				
Social Sciences	1	224	533	42%
Biological and Biomedical Sciences	2	55	533	10%
Psychology	3	41	533	8%
Yale University				
Business Management, Marketing, and Related Support Services	1	620	4,984	12%
Health Professions and Related Programs	2	601	4,984	12%
Social Sciences	3	551	4,984	11%
University of Maryland				
Computer and Information Sciences and Support Services	1	1,634	11,819	14%
Business Management, Marketing, and Related Support Services	2	1,620	11,819	14%
Engineering	3	1,572	11,819	13%
Drexel University				
Health Professions and Related Programs	1	1,991	6,831	29%
Business Management, Marketing, and Related Support Services	2	1,049	6,831	15%
Engineering	3	927	6,831	14%
Pennsylvania State University				
Business Management, Marketing, and Related Support Services	1	2,340	13,826	17%
Engineering	2	2,046	13,826	15%
Computer and Information Sciences and Support Services	3	1,494	13,826	11%

Table 15: Case Study Table

College/University	Location	Issues	Strategy	Success
Trinity College	Hartford, CT	Declines in Manufacturing	Developed a learning corridor including the creation of four magnet schools and neighborhood revitalization near campus.	Improved local educational programs, learning outcomes, quality of life
		High Poverty		Learning opportunities for students
		Segregation, Race, and Income		
University of Maryland	College Park, MD	Busy highways divided campus.	$2 billion partnership between local governments, state, and private developers.	30+ projects including mixed use development with research space.
		Lack of a college town feel		New Businesses and more housing options
		Poor Walkability in Downtown		New trails and parks.
Pennsylvania State University	State College, PA	Rising housing costs, traffic, and crime	Invent Penn initiative in 2015 to stimulate economic development, job creation and student careers. Entrepreneurship programs and collaboration between town and campus	Innovation Park which combines business and research/development
		Challenges balancing needs of the town and the University		$57 million innovation hub with entrepreneurial resources
Yale University	New Haven, CT	Economic challenges as people moved out of the city	New Haven Works initiative connecting the University and the city, tackling unemployment, proving workforce training, and hiring, promoting economic stability. Creation of an entrepreneurship center in collaboration with employers.	4,300 residents involved in the jobs program
		Closed businesses, falling population		525 thousand square foot research space targeted at life science's companies
		Rising crime and inequality		investments in walkability between downtown and surrounding neighborhoods
Drexel University	Philadelphia, PA	High poverty and crime	$1 billion uCity square development combining residential, commercial, research and educational space. Focused on bringing campus innovations to market.	Over 400 units of residential housing
		Lack of economic growth locally		New health science building
		Needed more opportunity for students		Part of a larger, mixed use development which hosts life science tenants as well as additional housing.