Center for an Urban Future

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GROWING AND DIVERSIFYING BROOKLYN'S INNOVATION ECONOMY

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GROWING AND DIVERSIFYING BROOKLYN'S INNOVATION ECONOMY

In little more than a decade, Brooklyn has emerged as a national leader in the innovation economy. The borough's recent growth in tech start-ups, creative companies, and innovative manufacturers is outpacing the rest of New York City and many other leading cities nationwide. This runaway success in the innovation industries has been a boon to both Brooklyn and New York City, adding thousands of new, well-paying jobs across Brooklyn, diversifying the borough's economy, and giving Brooklyn an important competitive advantage in a part of the economy that is expected to grow significantly in the years ahead.

But despite its success, Brooklyn still has a ways to go to fully realize its vast potential in the innovation economy. For instance, although a disproportionate share of people working in tech and creative fields in New York City live in Brooklyn, surprisingly few large innovation companies have relocated to the borough. And though Brooklyn is teeming with small and mid-sized start-ups, many of them have struggled to scale up while remaining in the borough.

As this report details, a handful of challenges—from a lack of good intra-borough transit options to an insufficient amount of affordable office space for growing companies—are threatening to constrain Brooklyn's future growth in the innovation economy.

At the same time, Brooklyn has work to do to make sure that the growth occurring in its innovation industries is more inclusive. While our research finds that the share of black and Hispanic workers in Brooklyn's tech workforce is notably higher than in many other major tech hubs such as Boston, San Francisco, and Seattle, significantly more progress is needed in expanding access to the good jobs being created in Brooklyn's innovation economy.

Although the borough boasts some of the city's best schools, colleges, and workforce development organizations, our research finds that Brooklyn is still lacking in education and training programs that help expose Brooklyn residents to career pathways in the innovation economy and prepare Brooklynites for these jobs.

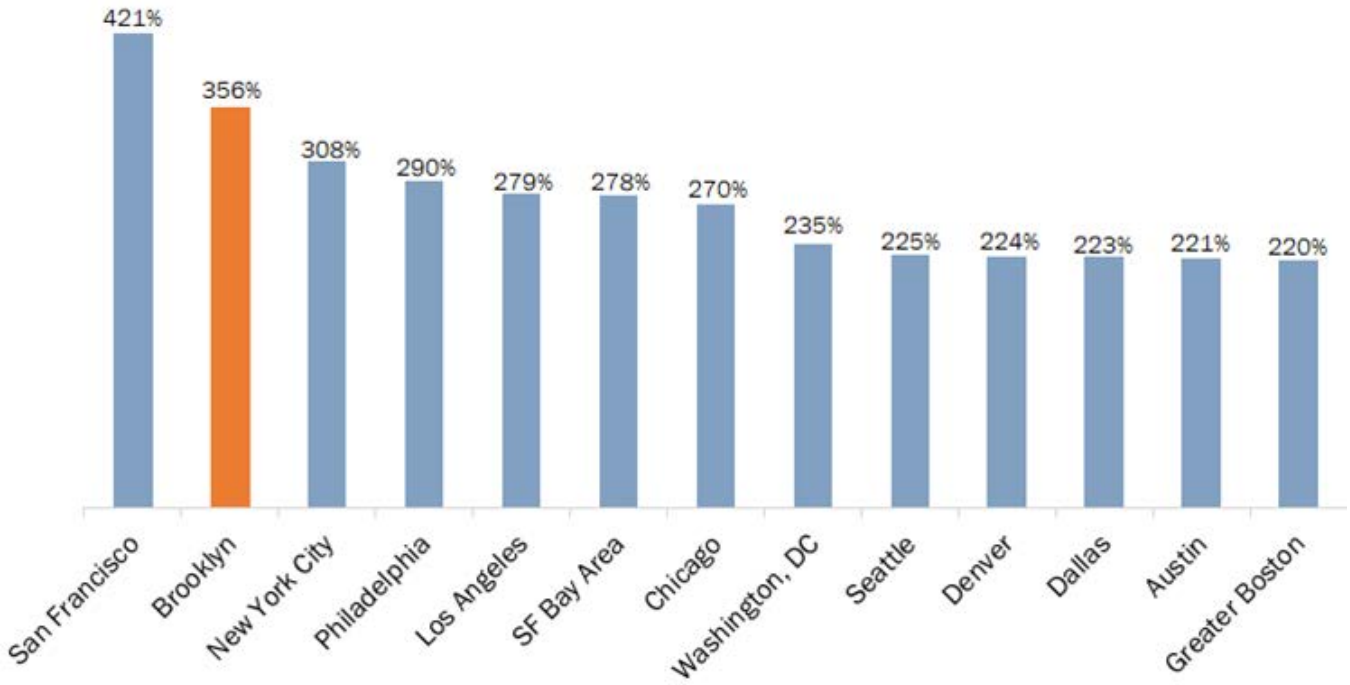
There is much at stake for Brooklyn to address these challenges and build a larger and more inclusive innovation economy. Doing so could mean thousands of additional well-paying jobs for residents across the borough in the years ahead, a welcome prospect at a time when a disproportionate share of the job growth nationally and in New York has been in low-wage industries—and when a new wave of automation will likely cause some good jobs to disappear.

This report outlines the key obstacles to growing Brooklyn's innovation economy and creating new pathways into these jobs—and it puts forth a series of achievable recommendations to overcome these challenges and realize the borough's immense potential to develop a larger and more inclusive innovation economy. Researched and written by the Center for an Urban Future and produced in partnership with Downtown Brooklyn Partnership, Dumbo Improvement District, Brooklyn Navy Yard Development Corporation, and Industry City, it is informed by interviews with more than 50 company founders, investors, educators, workforce development organizations, real estate developers, and economic development officials in Brooklyn, as well as more than a dozen experts working in relevant fields outside of the city. It builds on the Center's June 2019 data brief, *Brooklyn's Growing Innovation Economy*, which provided a new level of detail on the diverse mix of tech start-ups, creative companies, and entrepreneurial makers and manufacturers that are flourishing in Brooklyn today.

Our research shows that Brooklyn is one of just a handful of regions across the country to capture a significant share of the growth occurring in the innovation economy—a set of industries fueled by technology, creativity, and invention that is driving much of the nation's high-wage job gains. In 2018, for instance, Brooklyn was home to 1,205 tech-powered start-ups—a remarkable increase from 264 start-ups a decade ago. Additionally, employment in Brooklyn's creative industries surged by 155 percent over the past decade, nearly ten times the growth rate of Manhattan. And Brooklyn's manufacturing sector has significantly outperformed the city's, with much of the growth coming from a new generation of companies at the intersection of manufacturing, technology, and design.

Nearly everyone we interviewed said that Brooklyn is well positioned for even more growth in the core industries of the innovation economy. Today, Brooklyn has a strong foundation of tech start-ups, creative companies, advanced manufacturers, and entrepreneurial makers that either started in the borough or have been planting roots here for several years. The borough is home to an unmatched pool of tech and creative talent. It also has a more diverse innovation economy workforce than most other cities, a point of strength at a time when many employers are understandably feeling pressure to diversify their workforces. And Brooklyn benefits from a robust

Start-up Growth Rate Since 2008 in Major U.S. Tech Hubs



Source: CUF analysis of data from Crunchbase

innovation infrastructure—with vital R&D centers like NYU Tandon School of Engineering and New Lab, and roughly 60 incubators and co-working spaces.

But as much as Brooklyn has going for it in the innovation economy, several challenges could dampen the borough's future growth. According to our research, the biggest obstacles to growth include:

- **Transit Gaps** – With more subway stations than any other borough, Brooklyn's expansive transit network is one of the borough's greatest assets. Yet in our interviews with innovation economy leaders, transit was also one of the most frequently cited obstacles to the growth of the borough's innovation economy. In particular, our research found growing concerns about two types of transit gaps:
    - *Limited intra-borough transit connections*. Although there is a large tech and creative workforce living in Williamsburg, Greenpoint, and Bushwick, interviews suggest that many opt to commute to jobs in Manhattan because of the lack of efficient transit options connecting North Brooklyn to innovation economy job centers in Dumbo, Downtown Brooklyn, and Sunset Park.
    - *Long commutes from the surrounding region*. Large innovation companies are often deterred from moving to Brooklyn because they need to draw talent from all over the region but find Brooklyn lacking in easy transit commutes from New Jersey, Westchester, and even Long Island. Several company founders cited the lack of a direct ferry connection between New Jersey and Brooklyn, while others noted that employees commuting from Westchester are turned off by the additional 20- to 45-minute commute time to Brooklyn after arriving at Grand Central Terminal. And at a time when companies face fierce competition for top talent, these commuting challenges become a major factor in siting decisions.
- **Space Constraints** – A second key challenge raised in the majority of our interviews is the limited supply of affordable commercial space in neighborhoods across the borough that are most attractive for innovation companies. Although innovation companies are certainly not the only ones facing real estate obstacles in Brooklyn today, we heard about two specific space-related challenges that have become a major barrier to the borough's growth in the innovation economy:
    - *Next-stage space for start-ups to grow*. Brooklyn has no shortage of incubators, but start-ups outgrowing those facilities often find it difficult to locate other affordable spaces within the borough—especially in the neighborhoods that are seen as most attractive by innovation companies. "I have seen companies start in Brooklyn or consider Brooklyn, but they couldn't get the right size space for around 25 to 40 people," says Charlie O'Donnell, founder of Brooklyn Bridge Ventures, a seed stage investment fund. "We have to make sure these emerging companies stay and grow here," adds Sayar Lonial, the associate dean for communications and public affairs at NYU Tandon, who says that companies coming out of NYU's incubators often struggle to find the 500 to 5,000 square foot space with flexible leases they need as they grow.
    - *New commercial space in high-demand neighborhoods*. Despite extremely low commercial vacancy rates, relatively few new office spaces are being built in Brooklyn. This is likely the result of zoning rules that give preference to residential development and create few incentives for developers to build commercial projects. At the same time, several of the most in-demand neighborhoods are home to commercial buildings that have clear potential to house innovation companies but are being used instead for municipal uses—from the tow pound at the Brooklyn Navy Yard to the Board of Election storage facility in Downtown Brooklyn—and for self-storage.

In addition, our research identified a range of other challenges that could inhibit the growth of the innovation economy in Brooklyn, if left unaddressed. These include:

- Talent shortages, particularly for engineers, software and hardware developers, UX designers, data scientists, cybersecurity specialists, and other highly specialized workers.
- Rising housing costs, which could make it difficult for the borough to hold onto its greatest competitive advantage in the innovation economy: its highly educated and entrepreneurial workforce.

Diversity of Workforce in Tech Occupation, Leading U.S. Tech Hubs, 2017

	Black	Hispanic	White	Asian
Brooklyn	14%	8.8%	54%	20.4%
NYC	8.7%	10.9%	46.9%	30.9%
SF Bay Area	2.2%	5.3%	38.9%	50.3%
Boston	3.7%	5.5%	68%	19.1%
Seattle	2%	4.3%	60.2%	30.1%
Los Angeles	5.4%	17%	40.4%	33.9%
Dallas	12.4%	8.5%	50.5%	26.1%
Houston	13%	13.1%	47.5%	24.1%
Austin	4.7%	14.1%	61.7%	17.5%
Chicago	8.7%	8.8%	58.6%	21.9%
Washington, DC	25.6%	6.3%	48.1%	16.9%
Philadelphia	13%	6%	61%	16.6%
Portland	1.7%	5.2%	80.9%	9.5%

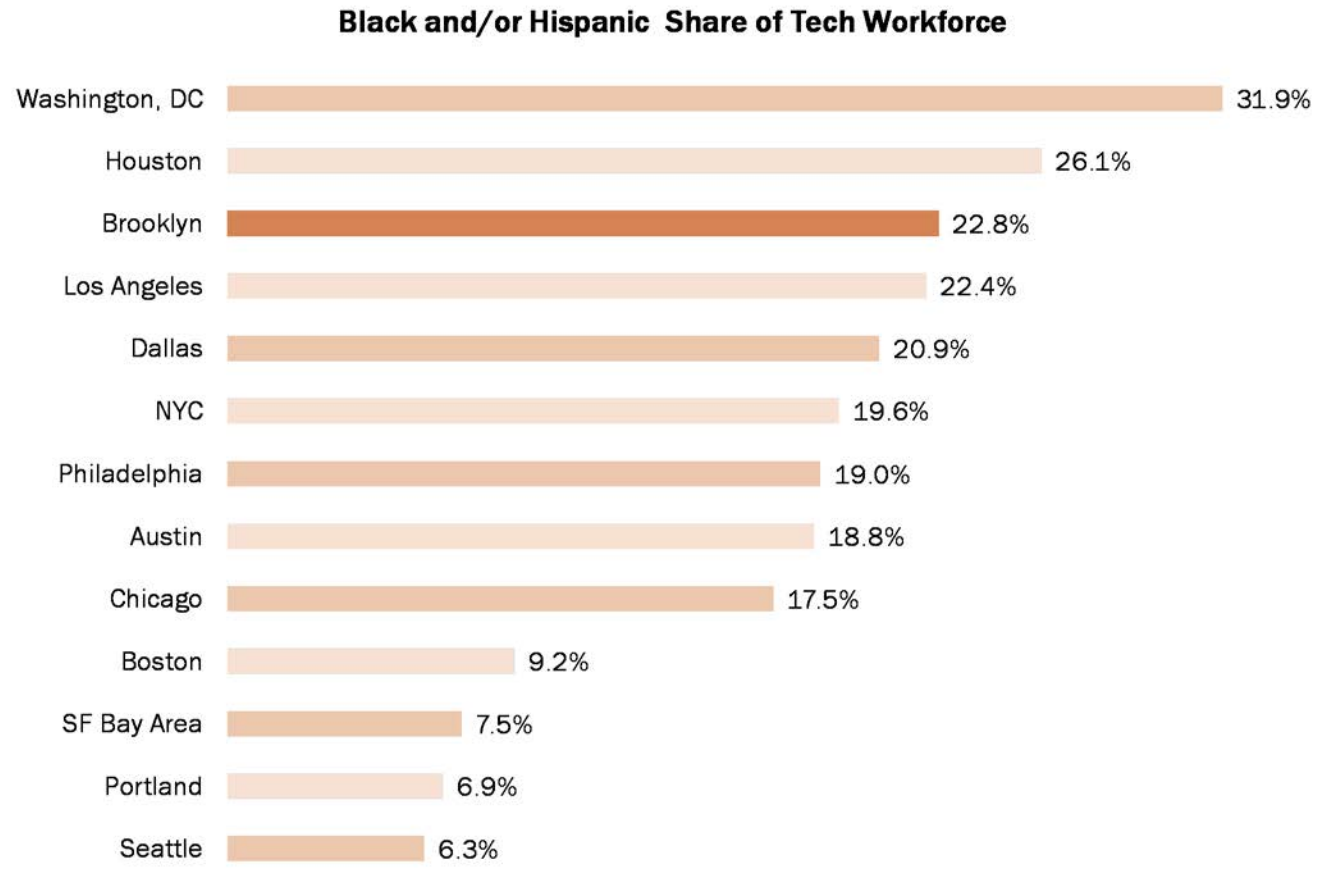
Source: Center for an Urban Future analysis of 17 tech-specific occupations, using data from the 2017 American Community Survey. Our analysis employs similar methodology to a 2018 Brookings Institution study and a 2016 U.S. Census Bureau report.

- Concerns about Brooklyn's ability to maintain its creative edge amid rising costs and the proliferation of national chains.
- Questions about the future of the Relocation and Employment Assistance Program (REAP), which will terminate next year if it is not reauthorized in Albany. REAP provides income tax credits of up to $3,000 per employee for companies relocating jobs to Brooklyn (and the other three boroughs outside of Manhattan) from outside the city or below 96th Street in Manhattan. According to our research, many of the innovation companies based in Brooklyn today would not have relocated to the borough without the REAP incentives.

While Brooklyn has more to do to keep its innovation economy growing, it also will need to take steps to ensure that a lot more residents from Brooklyn's lower-income communities are able to access the well-paying innovation industry jobs being created in the borough.

Jobs in the borough's innovation economy have the potential to become the middle-income career paths of the future, transforming the lives of New Yorkers from lower-income backgrounds. But to realize this potential, city and local leaders needs to make significant strides in equipping Brooklynites with the skills and experience necessary to succeed in the innovation economy. Indeed, it was abundantly clear from our site visits and interviews that Brooklyn's innovation economy workforce does not adequately reflect the borough's diversity.

Brooklyn is far from the only city with a troubling opportunity gap in the innovation economy. In fact, an analysis we conducted for this report shows that Brooklyn's tech workforce is notably more diverse than several other leading tech hubs. According to our analysis of 17 tech-specific occupations, Black and Hispanic workers account for 22.8 percent of Brooklyn's tech workforce (14 percent Black and 8.8 percent Hispanic).[1] This is significantly higher than Boston (9 percent Black and Hispanic combined), the San Francisco Bay Area (7 percent), and Seattle (6 percent).



Source: Center for an Urban Future analysis of 17 tech-specific occupations, using data from the 2017 American Community Survey.

The comparatively diverse workforce is a clear strength for Brooklyn's innovation economy. But there is still much more progress to be made in a borough where the overall workforce is 27 percent Black and 21 percent Hispanic.[2]

Our research took a close look at how to expand access to the jobs in Brooklyn's innovation economy. We conclude that the borough's leading stakeholders—including policymakers, leaders of academic institutions, heads of workforce development organizations, philanthropic foundations, and innovation economy employers—will need to make meaningful new investments to expand and improve the borough's education and workforce training infrastructure. In particular, Brooklyn's stakeholders will need to address the following specific challenges that were surfaced in our research:

- **Greatly expand the number of Brooklyn residents with a college credential** – A large share of the well-paying jobs in the innovation economy typically require at least a bachelor's degree, but just 35 percent of adults in Brooklyn hold a BA or higher, compared to 61 percent in Manhattan—and many of Brooklyn's college graduates are more recent arrivals from other cities. College attainment rates are considerably lower in many neighborhoods, including Brownsville (where 13.6 percent of adults have a BA or higher), East New York (14 percent), Canarsie (18.6 percent), Sunset Park (19 percent) and East Flatbush (22.5 percent).

- **Scale up the borough's tech training programs** – Although there are some notable exceptions, Brooklyn is home to relatively few training organizations with specific, in-depth programs tailored to careers in technology, creative industries, and innovative manufacturing, and most programs are serving just a few dozen participants annually. Moreover, the vast majority of the borough's tech training programs only offer basic digital literacy and computer skills. Though there are a handful of more in-depth tech training programs that can lead directly to a well-paying tech job, these programs are also small, collectively serving no more than a few hundred people each year.

- **Increase the number of employers that recruit and hire local residents** – Too few of the borough's employers in the innovation industries have established efforts to hire locally, recruit from CUNY, partner with the borough's workforce development organizations, and offer hands-on career-exploration opportunities and paid internships to Brooklyn residents. There are a number of important exceptions, including dozens of companies that work with the place-based employment centers at the Brooklyn Navy Yard, Industry City, and Brooklyn Army Terminal. But there's no question that a lot more Brooklyn-based innovation companies will need to take affirmative steps to recruit, hire, and train local residents.

- **Expand work-based learning** – There are hardly any apprenticeship programs so far in Brooklyn's tech or creative sectors, although a new apprenticeship program for CNC technicians is connecting Brooklynites to jobs in advanced manufacturing. And while Brooklyn has a number of new Career and Technical Education (CTE) programs in public high schools, just one is in computer science and too few programs have meaningful partnerships with Brooklyn employers or are embedded among the borough's job clusters.

- **Strengthen Brooklyn's CUNY campuses and foster partnerships between these colleges and local employers** – Brooklyn's four CUNY colleges have an important role to play in expanding access to careers in the innovation economy. As one example, graduates of Downtown Brooklyn–based New York City College of Technology (City Tech)—where 61 percent of students come from households earning under $30,000 annually—have the highest median earnings one year after graduation of all CUNY colleges citywide ($41,564), serving as a testament to the power of a postsecondary credential aligned with STEM careers. But all four Brooklyn-based CUNY institutions could benefit from additional resources and from investments to more closely align with the needs of employers in the innovation economy. For example:

    - None of the Brooklyn-based CUNY campuses offers a bachelor's degree program in engineering.[3]

    - In 2016-17, the four Brooklyn CUNY campuses produced just 2,275 STEM graduates, with roughly half (1,203) coming from City Tech. Although the number has increased in recent years, there's an opportunity to further boost these numbers.

    - Only 15.4 percent of undergraduates at Medgar Evers College and 19.4 percent of students at City Tech participated in an internship, according to the 2018 CUNY Student Experience Survey. Of the borough's three senior colleges, only Brooklyn College (where 23 percent of undergrads participated in an internship) surpassed the citywide senior college average (21.7 percent). Meanwhile, just 10.2 percent of students at Kingsborough Community College participated in an internship, which is roughly on par with the citywide community college average (10.3 percent).

- **Expand bridge programs** – Brooklyn has very few bridge programs designed to connect people with the greatest barriers to employment—like limited English and math skills and no high school diploma—to job training and further education.

Brooklyn has a golden opportunity to make progress on both areas that are the focus of this report: keeping its innovation economy growing and expanding access to the well-paying jobs in this sector. But it will require public sector leaders—in Brooklyn and at City Hall—working closely with leaders from industry, academic institutions, and nonprofit workforce organizations to make new investments and institute new policies to help the borough overcome some key challenges.

This report outlines the key obstacles to growing Brooklyn's innovation economy and creating new pathways into these jobs—and it puts forth a series of achievable recommendations to overcome these challenges and realize the borough's immense potential to develop a larger and more inclusive innovation economy.

THE SECRETS TO BROOKLYN'S SUCCESS IN THE INNOVATION ECONOMY

Our interviews with Brooklyn-based company founders suggest that Brooklyn's remarkable rise as a national leader in the innovation economy has occurred thanks to a number of factors. These include:

A Highly Educated & Entrepreneurial Talent Base

For most of the Brooklyn-based company founders we interviewed, one clear competitive advantage stood out: the fact that much of their talent base already lives in the borough.

"We made a strategic decision to move to Brooklyn," says Meryl Draper, president at The Quirk Creative, a video advertising agency at Industry City, who founded her firm in San Francisco before moving to Brooklyn in 2016. "There is a concentration of creative e-commerce and advertising talent here. Advertising has long been synonymous with New York City, but now we are seeing that shift to Brooklyn."

"Where else would we find and attract such incredible talent across fintech, creative agencies, start-ups, and digital media?" says Dayan Anandappa, general manager of the United Technologies (UTC) Digital Accelerator, which set up shop in Dumbo roughly two years ago and now has approximately 150 employees there.

For many founders, starting their companies in Brooklyn was an easy decision—it's where they had already chosen to live. Of the 30 Brooklyn-based innovation companies surveyed for this report, 23 say that more than half their employees live in Brooklyn. At many companies with fewer than 15 employees, nearly the entire staff lives in the borough.

"Everyone that works for us so far has lived in Brooklyn," says Eva Goicochea, who moved to New York after helping to build Everlane, an industry-leading direct-to-consumer fashion company. She went on to found Maude, a Williamsburg-based company that sells sexual wellness products. "Many of us walk to work, and it just feels like we are all very much Brooklynites."

Commercial Space is More Affordable Than in Manhattan

Many other founders we interviewed said they set up shop in the borough or moved to Brooklyn for its comparatively affordable real estate prices and plentiful incubators and co-working spaces. Indeed, we identified approximately 60 co-working spaces across the borough, up from fewer than five a decade ago.

For Jessie Lazarus, vice president of business development at Carmera, a data start-up building mapping tools for the autonomous vehicle industry, Brooklyn's abundance of early-stage start-up spaces has delivered a major boost. "We live in an NYU incubator, and we've probably been in every incubator in Brooklyn as our company has grown," she says. "It's so important that we've been able to find space to accommodate our team as it's gone from three to six to now 20 and soon 50—and we've been able to maximize our opportunities along the way."

Companies Moving to the Borough Can Access Incentives Like REAP

Adding to the real estate advantage over Manhattan, several Brooklyn innovation company executives also mentioned the city's Relocation and Employment Assistance Program (REAP), which provides income tax credits of up to $3,000 per employee for companies relocating jobs to Brooklyn (and the other three boroughs outside of Manhattan) from outside of New York City or below 96th Street in Manhattan.

"We moved 85 employees from the West Village to Industry City, and REAP was the deciding factor," says Pete Abel, founder of AbelCine, a full-service provider of equipment and services to the film and TV industry. "With that savings, we were able to build a facility that's almost twice as big as what we had in the West Village. It wouldn't have been possible without it."

"I was attracted to New York and Brooklyn because of the incredible diversity, the multiculturalism unmatched anywhere, the sense of opportunity, and the creative energy."

Brooklyn's Creative Edge

Several founders said they were drawn to Brooklyn's creative energy, as well the opportunity to work in close proximity with a diverse mix of companies, including manufacturers, visual artists, designers, and tech start-ups. "I was attracted to New York and Brooklyn because of the incredible diversity, the multiculturalism unmatched anywhere, the sense of opportunity, and the creative energy," says Harry Doull, the co-founder of Keap, a natural candle manufacturing company with an online-focused business model that is based in Industry City in Sunset Park. "I sensed that things were possible."

Related to this, many founders said that the unique local options for restaurants, shopping, entertainment, and nightlife are a big part of Brooklyn's appeal.

Brooklyn's R&D Infrastructure

For some, the presence of NYU Tandon, New Lab, and other centers of R&D activity was a huge plus—or, in many cases, the reason they got started in Brooklyn. Altogether NYU Tandon's Future Labs network of technology acceleration hubs are minting 15 to 20 new companies each year, many of whose founders want to stay in the borough. Successful graduates of NYU Tandon Future Labs programs include Radiator Labs, which helps city buildings that use steam heat reduce their energy use by deploying smart radiator covers; and EV Box, a fast-growing cleantech company that manufactures and distributes electric vehicle charging technology worldwide.

The Borough's Diversity

Brooklyn's diverse population was often cited as a major draw, contributing to vibrant communities and distinct retail and restaurant options, and allowing companies to recruit staff from a mix of different backgrounds. Indeed, we also heard that the borough's comparative success in achieving a diverse workforce in its innovation industries is an important way that Brooklyn stands out. According to an analysis we completed for this report, 14 percent of Brooklyn's tech workforce is Black, compared to just 2 percent in the San Francisco Bay Area, 2 percent in Seattle, 5 percent in Los Angeles, 7 percent in Manhattan, 9 percent in Boston, and 9 percent in Chicago.

BARRIERS TO GROWING BROOKLYN'S INNOVATION ECONOMY

Building on the borough's innovation assets would be a boon to both Brooklyn and New York City. But despite its considerable advantages, continued growth in the innovation industries is far from a given. Brooklyn faces a number of challenges to keeping the growth of its innovation economy going.

Commuter Blues: Brooklyn's major transit gaps

More than half of the start-up founders we interviewed cited gaps in the borough's transit infrastructure as a critical challenge that, if left unaddressed, will likely present bigger problems down the road. Though Downtown Brooklyn, Williamsburg, Sunset Park, Dumbo, and many other communities in the borough boast strong transit connections to and from Manhattan, getting from one part of the borough to another can be a major challenge, with consequences for recruiting and retaining employees, founders, and companies themselves.

For instance, Williamsburg and Greenpoint are home to one of the city's highest concentrations of people working in the innovation economy, but there is no quick route via transit from there—or from neighborhoods like Bushwick and Ridgewood—to parts of the borough where innovation economy jobs are growing, like Dumbo, Brooklyn Navy Yard, Downtown Brooklyn, and Sunset Park. Using mass transit, the trip from Bushwick or Ridgewood to Main Street in Dumbo or the Brooklyn Navy Yard takes at least 45 to 50 minutes with good service, and well over an hour to Sunset Park.

Many north Brooklyn residents have opted to work for firms in Union Square, the Flatiron District, and Chelsea rather than travel by bus or multiple subway lines (for example, the G train to the F train, or the L train to a local bus) from one Brooklyn neighborhood to another.

Similarly, some say that Brooklyn could benefit from stronger connections to other parts of the New York City metro region. The larger the innovation company the more likely it will need to attract at least a portion of its workforce from beyond Brooklyn and Manhattan. We heard in our interviews that this may become a growing need as more of the borough's workforce enter their 30s and 40s and consider relocating to places in the region with more affordable space and stronger public schools.

A few of the people we interviewed for this report specifically mentioned the lack of a ferry connection between New Jersey and Brooklyn. In fact, since 2010, the number of daily commuters traveling from New Jersey to Brooklyn has doubled, from 21,534 to 42,983 in 2017. But a trip from Jersey City to Dumbo, Downtown Brooklyn, Sunset Park, or the Brooklyn Navy Yard typically takes over an hour.

"If we don't invest in and improve on Brooklyn's transit infrastructure, Brooklyn just won't be as appealing," says Anandappa of UTC.

Help Wanted: Growing challenges finding the talent to expand

Companies in all parts of the innovation economy—from tech start-ups to innovative manufacturers—are struggling to find enough of the skilled workers they need. Though Brooklyn innovation companies undoubtedly benefit from the borough's large talent pool of highly educated workers with tech skills, this is not always enough at a time when meteoric growth in the sector has created intense competition for a scarce number of engineers, programmers, and other specialized workers.

Smaller companies—which make up a disproportionate share of the tech companies in Brooklyn—face particularly steep challenges, since they struggle to match the compensation packages and other benefits offered to employees at Google, Facebook, and other large tech firms. Manufacturers often sit even further down the food chain, a growing problem since a growing share of the borough's manufacturing companies today need engineers, CNC machine operators, and other highly skilled workers.

"Tech and creative companies face struggles to recruit the talent their looking for with so much competition, and there is a feeling that it will get harder," says David Ehrenberg, president and CEO of the Brooklyn Navy Yard.

"That not only means hiring in the near future will be more difficult, but also that if companies can't hire entry-level employees, then they can't train them with the skills they need to become managers, resulting in a crunch all the way up the chain."

A 2018 survey by Tech:NYC and Accenture found that 83 percent of New York City-based tech companies planned to hire in the coming year, but only half were confident they could find the talent they needed[4]. That is borne out by our interviews with Brooklyn-based company executives. "Finding and retaining developers is notoriously difficult," says Jay Reno, the CEO of Feather, a tech-powered furniture subscription service. Reno cites increasing demand from start-ups, large tech companies, and media companies, among others.

"In general, it's a job seeker's market—and that's made it harder for us," adds one senior executive at a Brooklyn-based mobility start-up, who asked not to be named. "It's hard to find great tech talent for roles like hardware engineering, but it's also tough to find HR people."

Indeed, the challenge is not just for tech positions. As Brooklyn's vertically integrated, tech-powered manufacturers grow, demand is rising for workers who can sew, assemble, fabricate, test, pack, and perform quality control. Other innovation economy companies are creating different sorts of accessible and middle-skills jobs, like moped repair positions at Revel, which pay about $18 an hour; geographic information systems (GIS) technicians who could work at mapping or transit companies like Carmera; and fabricators in metal, plastic, wood, and glass, who use high-tech tools to prototype designs and produce everything from eyeglasses to office furniture.

These jobs are typically accessible without a college degree and pay more than jobs in retail or food service. But many require a higher level of technical skill or previous work experience, which means that employers sometimes struggle to find all the talent they need to grow. For Crye Precision at the Brooklyn Navy Yard, growing their business manufacturing high-tech combat gear demands a significantly larger workforce. "We're launching a lot of new lines and preparing to double our staff," explains Gregg Thompson, the company's co-founder. "But it's getting hard to find people in Brooklyn who can do the complicated work we do in a high-volume way."

Room to Grow: Lack of commercial space to level up

Another challenge is the relative lack of space for growing innovation companies. Brooklyn has no shortage of incubators, but start-ups outgrowing those spaces often find it difficult to locate other affordable facilities within the borough. Beyond incubator graduates, many companies in the midst of scaling up find a particular dearth of office space for their medium-sized firms.

"Never before has the market in Brooklyn been so incredibly tight," says Caroline Pardo, managing director of commercial leasing at TerraCRG, one of Brooklyn's largest commercial real estate brokers. "It's hard to find vacancies, especially for small to mid-sized start-ups."

Speedy growth has been the norm for Feather. The company moved to Dumbo after a stint at Y Combinator and has grown to 55 employees after recently landing $12.5 million in Series A funding. As the company grew, CEO Jay Reno began searching for his next office at the end of 2018. "We do not want to leave Dumbo," he said at the time. "We just don't know if we can help it." While he found a warehouse to lease in the Wallabout area, where he could store Feather's 100,000-piece furniture inventory, he ultimately decided to move Feather's main office to SoHo in March 2019.

Planning for Growth: Impediments to creating work space

Despite Brooklyn's net gain of nearly 1,000 new tech start-ups and hundreds of additional creative businesses and makers over the past decade, a relatively small number of new office spaces have been built in Brooklyn during the same period. This already contributing to the space challenges across the borough, where vacancy rates are close to zero in several of the most in-demand districts. But it will almost certainly become an even bigger problem in the years ahead when the borough will need even more room to accommodate the industry's expected growth.

Though some commercial developments have started to come on line, our interviews suggest that there are still numerous obstacles to creating more of the flexible, affordable office spaces that innovation companies need—from zoning that favors residential projects to political opposition.

In Dumbo, for instance, a 2009 rezoning expanded the floor area ratio (FAR) for residential development, allowing greater density per lot. But the same plan kept the commercial FAR at the same low level—2.0, or 4.8 with community space. Last August, a new development at 29 Jay Street received permission through ULURP to build an 11-story, 190,000 square foot building with a FAR of 10.0, the same restriction as for residential buildings in the area. Several other low-rise buildings on Jay Street are well-positioned to expand similarly. But because the land use review process requires a major investment of time, money, and motivation from landlords, very few new projects have gotten off the ground. "Adding commercial space on existing lots is a natural fit for today's Dumbo,"

Sica says. "This is where the companies want to be."

The same is true for much of Brooklyn's innovation economy corridor, where new residential construction has far outpaced the development of commercial office and flexible workspace. Downtown Brooklyn in particular would benefit from an increased commercial FAR.

The space crunch is just as acute a few miles north in Williamsburg, where thousands of New York's creative and tech employees live. While aspiring entrepreneurs have access to a number of co-working spaces, and, further east, to industrial buildings that can offer low-cost space with minimal amenities, the supply of flexible office space is extremely low. In part because of 2003's residential-focused rezoning, the neighborhoods have seen just one new office building in the past half century, creating a crunch for companies who would like to make the most of the creative energy in the area and remain accessible to their employees.

The Department of City Planning's North Brooklyn Industry and Innovation plan, released in the fall of 2018, takes steps to recognize the need for flexible office space along this corridor, where non-industrial jobs grew by 23 percent from 2010 to 2016—a rate four times that of industrial jobs over the same period. By suggesting a new "Growth District" around the Morgan and Jefferson L train stops, the city's plan promises to recommend some flexibility in land use policy to increase density or new commercial development that would suit companies in the innovation economy. But pushback from some neighborhood stakeholders and elected officials has put the proposal on hold.

Maintaining Brooklyn's Creative Edge

Brooklyn's innovation economy rests on a foundation of creativity. The borough's concentration of artists, musicians, designers, record studios, and arts venues was critical to creating the environment that attracted tech professional to Brooklyn. At the same time, the first wave of innovation companies in Brooklyn mainly went to neighborhoods that already had a significant presence of artists and creative companies. Nearly every company founder we interviewed mentioned Brooklyn's arts and culture as a significant piece of the borough's allure and a reason for locating there.

But there is growing concern that Brooklyn's rising costs may be jeopardizing this creative ecosystem. Brooklyn still has an impressive mix of performing arts organizations, but some of those we interviewed say that Brooklyn's innovation cluster will suffer if the borough loses its edge as a home for working artists and creators of all kinds.

"Brooklyn's creative energy comes from its diversity," says Harry Douall of Keap Candles. "It's part of our brand. But I worry about maintaining that. If Brooklyn becomes more homogenous, it will lose its edge and its attractiveness to the creative young people we want to hire. If we lose that, we're like any other city."

Stakeholders in neighborhoods that are seeing growth in the innovation economy risk jeopardizing what makes Brooklyn special if they don't take the time to carefully plan the features that attract so many to Brooklyn, whether through walkability, green space, arts venues, lunch options, or eclectic streetscapes. "Placemaking is important for maintaining Brooklyn's edge," says Julie Samuels of Tech:NYC.

JJ Kasper, who runs Blue Collective, a venture capital firm based in Brooklyn, also cites a risk for Brooklyn's innovation economy if the borough loses its unique storefront businesses and homegrown places to eat, shop, and hang out. "I like the fact that Brooklyn is still not exactly like Manhattan," he says. "It has up and coming restaurants and chefs, new businesses, and boutiques, in the way the West Village used to have. But now the West Village is all brand names."

Rising Housing Costs

If not addressed, affordability issues could also undermine what has arguably been the single most important ingredient to the borough's success in the innovation economy: its highly educated workforce. If Brooklyn's skyrocketing housing costs cause it to lose the engineers, designers, marketing experts and other highly educated professionals that now live in the borough, companies will have fewer reasons to locate there.

Creating a Cohesive Innovation Community

One final concern is that Brooklyn still has work to do to build a cohesive community in the innovation economy. The borough's innovation ecosystem is arguably as strong as it's ever been. But given the size and scope of the sector, some say that Brooklyn's innovation companies could benefit if there were more opportunities for leading stakeholders from different neighborhoods across the borough to come together.

"As the Brooklyn community evolves, I have seen a lack of a cohesive way to put the companies in the same place to share best practices, where they can talk about office space, finding lawyers, the mundane but important things," says Jimmy Chen, founder and CEO of Propel, a software start-up that makes safety net services more user-friendly.

EXPANDING ACCESS TO JOBS IN BROOKLYN'S INNOVATION ECONOMY

As important as it is to sustain and grow Brooklyn's innovation economy in the years ahead, the borough will also need to make sure that far more Brooklynites from lower-income backgrounds are able to access opportunities in this sector.

Our interviews and site visits make it clear that the people working in the borough's innovation economy do not fully reflect the borough's diversity. The data also backs it up. An analysis we conducted for this report finds that 54 percent of Brooklyn's tech workforce is white, 20 percent is Asian, 14 percent is Black, and 9 percent is Hispanic. Another 3 percent identify as another ethnicity, according to our analysis of 17 tech-specific occupations that used data from the 2017 American Community Survey.

A lack of diversity in tech and creative industries is a national problem that resonates far beyond Brooklyn. Innovation hubs from New York City and Boston to San Francisco and Seattle are driving much of the nation's high-wage job growth, but almost none of these industries reflects the diversity of these cities as a whole. Compared to the nation's entire workforce, tech employees are more likely to be white or Asian and male—a pattern that holds true across all 15 of the nation's largest tech hubs.

The good news is that Brooklyn-based tech companies have made strides in diversifying their workforce where other cities have not. Our analysis shows that Brooklyn has a higher share of black tech workers than most other major tech hubs nationwide. Whereas 14 percent of Brooklyn's tech workforce is black, the rates are notably lower in the San Francisco Bay Area (2 percent), Seattle (2 percent), Los Angeles (5 percent), Manhattan (7 percent), Boston (9 percent), Chicago (9 percent), and Houston (13 percent).

But significantly more progress is needed.

Our research finds that Brooklyn-based innovation companies can and must do more to recruit and hire from the borough's diverse communities. But we find that a bigger challenge is that too few residents are gaining the skills and credentials typically needed to access career paths in the innovation economy, and that the borough's skills-building and education infrastructure is lacking in several ways.

Ultimately, we conclude that the borough's top policymakers need to develop a bold vision for tackling the opportunity gap in Brooklyn's innovation industries, working closely with university leaders, industry executives, workforce development officials, and heads of community-based organizations from across the borough. This vision will need to be matched by resources, and it will need to address the following human capital challenges:

Brooklyn has too few workforce training programs that prepare resident for technology or creative careers, and those that do exist operate at a very small scale.

Brooklyn's multitude of workforce development programs and initiatives provide a wide range of services, from interview coaching and resume preparation to multi-week job training for careers in construction, retail, food service, clerical work, industrial jobs, commercial driving, and many other occupations. But a review of the landscape of workforce programs in Brooklyn finds that only a handful are currently designed to prepare participants for careers in tech or the creative industries.

There are fewer than a dozen workforce development programs operating in Brooklyn that offer programs specifically tailored for jobs in the borough's innovation industries. For instance, our research identified fewer than ten Brooklyn-based programs that offer multi-week programs focused on technology careers, including OBT, Per Scholas, Kingsborough's TechWorks program, NPower, and Access Labs. In addition, our research could only identify a handful of programs aimed at preparing Brooklyn residents from low-income backgrounds for careers in the creative

"Brooklyn needs strategic investments in place-based collaboratives and intermediaries that meet employers where they are."

industries, such as Brooklyn Workforce Innovation (BWI)'s Made in NY training program for production assistants; Made in Brownsville's 12-week programs in 3D technology and design; and a new program called The Animation Project, which operates a four-month weekly training program with a stipend designed to prepare Brooklyn residents for careers in computer animation. Other free tech training programs—such as the NYC web development fellowship and the data analyst training accelerator course offered through the city's Tech Talent Pipeline—are available to Brooklyn residents but not offered in any Brooklyn locations.

Between OBT, Per Scholas, Kingsborough's TechWorks program, NPower, and Access Labs, fewer than 300 people are graduating from free, in-depth technology training programs each year in Brooklyn. Made in NY's production assistant program serves about 80 participants per year, while BWI's newer postproduction training program serves about 50. Other programs focused on creative occupations like The Animation Project and Made in Brownsville are smaller still.

The de Blasio administration's recently launched ApprenticeNYC program is another key piece of the city's talent development infrastructure. By providing paid on-the-job training and a rigorous curriculum with strong industry partners on board, the program has the potential to serve as a significant springboard to economic opportunity for New Yorkers without a college credential. The program is also embedded in Brooklyn: ApprenticeNYC's first program, for CNC machinists, includes at least five Brooklyn-based employer partners and is based at the Brooklyn Army Terminal. The initiative has also supported other apprenticeship-like models, including the Tech Talent Pipeline's associate engineer program in software. But the initiative remains very small scale.

Most of the program directors we interviewed say that their initiatives could expand with more funding. Per Scholas believes that with additional capital resources and operating support it could graduate 1,500 students each year citywide, up from about 500 a year today, with similar gains in Brooklyn. But to expand initiatives more deeply into Brooklyn's innovation industries, more programs will need to collaborate with industry-facing intermediaries to build employment and training centers in the neighborhoods where jobs are growing the fastest. Those intermediaries will need to make the value proposition to employers that hiring locally is good for business—and that workforce training providers can help tackle hiring pain points with sufficient guidance, feedback, and data from the companies themselves.

"Brooklyn's training programs need resources to grow, but that's not all," says Aaron Shiffman, executive director of BWI. "Brooklyn needs strategic investments in place-based collaboratives and intermediaries that meet employers where they are. Those are challenging collaborations to resource, but it's working in the Navy Yard and Industry City and it could be working in the rest of the borough. If you can make investments in those intermediaries and incentivize nonprofits to work together—with one voice talking to the employers—it really does make a difference."

Brooklyn needs more bridge programs connecting residents with the greatest barriers to employment with effective training programs.

It may be surprising, but hundreds of thousands of Brooklynites lack the fundamental literacy, language, and numeracy skills needed to access most workforce training programs—not to mention the relatively small number of workforce programs that prepare people for jobs in the innovation industries. For these residents, expanding pathways to even the most accessible jobs in Brooklyn's innovation industries will require an expansion of bridge programs, which are designed to help adults who lack a high school diploma, are not proficient in English, or have low levels of literacy to acquire the skills they need to transition into training and higher education.

Currently, however, there are hardly any bridge programs operating in Brooklyn today. But data suggest that the need for these programs is significant.

In Brooklyn today, 19.3 percent of all adults over 25 lack a high school diploma—more than 340,000 residents in total. In addition, 23.6 percent of Brooklyn residents speak English less than very well, a total of more than 565,000 Brooklynites. In many low-income neighborhoods, the shares are much higher. For instance, in Sunset Park, 54.4 percent of residents speak English less than very well and 46.3 percent of adults lack a high school diploma. In Cypress Hills, nearly one-quarter of adults lack a high school diploma; in Brownsville, that figure is 26.5 percent.[5]

Many of these residents not only lack the basic skills needed to access innovation economy jobs; they also struggle to access existing training programs. Per Scholas, one of the city's most highly regarded tech training programs, is forced to turn away a majority of applicants, and leaders at the nonprofit say a lack of literacy skills is the main reason. Other effective tech-focused training programs—from OBT's TechSTART to Access Labs' software engineering program—generally require participants to hold at least a high school diploma or equivalent.

"Far too many people who come to BWI's door are not able to access CUNY or other training opportunities because of low literacy levels and limited language skills," says Shiffman of BWI. "If you want to tackle poverty in this city you have to tackle the literacy crisis, you have to work with immigrants for whom English might not be their first language, or whose credential might not resonate with an employer because their communication skills are poor. The city has to fully fund skills-building bridge programs to quality training and career education."

New York City has a small number of bridge programs that provide basic adult education in the context of a specific occupation or career path. These programs can help upskill adults in reading and math, helping prepare more New Yorkers to earn a high school equivalency diploma or access in-depth job training. But while several promising models now exist—including LaGuardia Community College's Bridge to College and Careers Program—there are no more than a handful of bridge programs available in Brooklyn today.

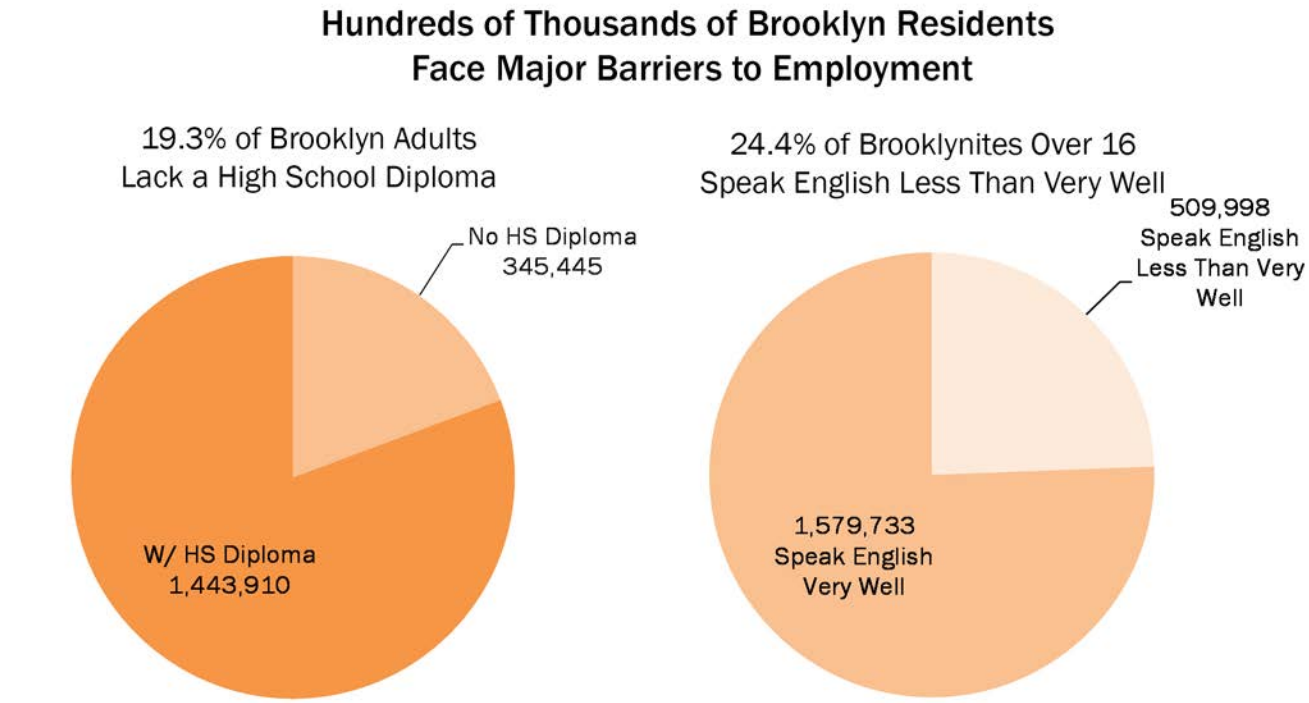
Brooklyn public school students need more opportunities to build skills and gain work experience relevant to the innovation economy.

While it will be critical to increase training opportunities for adults, it may be even more important to expand and improve offerings for Brooklyn students in grades K–12. Our research finds that even as many Brooklyn public schools have made important strides in recent years, significant gaps remain when it comes to providing students with the instruction and tools needed to prepare for careers in the innovation economy.

A 2016 survey of Brooklyn public schools by the Office of the Brooklyn Borough President found that only 30 percent of Brooklyn schools have a computer science curriculum and just 54 percent of schools reported having a teacher or staff qualified to teach computer science. In addition, many Brooklyn schools struggle to provide devices like laptops and tablets so students can work on tech projects both at school and at home. The same survey found that Brooklyn schools only have enough on-campus laptops to serve 20 percent of Brooklyn students, and enough tablets to reach just 7 percent of students.[6]

Among Brooklyn's 31 high schools that offer CTE programs, several new initiatives are preparing more students for careers in technology and the borough's creative industries. But these programs remain few and far between. For example Brooklyn has just one CTE program in web design, at the Academy of Innovative Technology High School in Cypress Hills, and the new Brooklyn STEAM Center at the Navy Yard offers the borough's only CTE program in computer science.[7]

Beyond the specialized programs aimed at preparing Brooklyn high school students for careers in the innovation economy, educators and other experts say that far too few Brooklyn students are able to access career exploration or internship opportunities in tech and creative companies while still in school. The Brooklyn STEAM Center is the only public high school in Brooklyn embedded in a workplace; in most other Brooklyn schools, career exploration and work-based learning is limited to the occasional field trip or career fair. One notable exception is at Industry City, where a partnership with Sunset Park High School and the Center for Family Life connects students to internships with a variety of businesses in tech, design, advanced manufacturing, and other industries. But according to administrators at several Brooklyn high schools and CTE programs, finding willing industry partners in the tech sector and creative economy remains an ongoing challenge.



Source: CUF analysis of data from the 2013-2017 American Community Survey.

Employers in Brooklyn's innovation industries need to increase local hiring and recruitment

Several employers in Brooklyn's innovation economy have taken aggressive steps to recruit diverse talent from the communities across the borough, but there is significant room for improvement. Too many innovation companies have not set up systems or practices to hire locally, recruit from CUNY, partner with the borough's workforce development organizations, and offer hands-on career-exploration opportunities and paid internships to Brooklyn residents.

Although some Brooklyn-based innovation companies simply haven't prioritized efforts to diversify their workforce, many others have tried and struggled to succeed. One key barrier is that the vast majority of companies in Brooklyn's innovation economy are small, and that these companies typically don't yet have an HR department that could take the lead on partnerships with local universities and workforce organizations.

"It's critical to invest in building a diverse workforce when your company is still small," says Adam Enbar, co-founder and CEO of Flatiron School. "But you're so focused on how to grow and succeed, it's a challenge to do it all. I think most Brooklyn founders care about hiring and developing more diverse talent, but many don't know what to do."

We also heard that many companies simply don't hear from skills-building organizations, and often don't know where to turn to develop those relationships on their own. Other companies told us that they aren't confident that workforce organizations will understand their talent needs and deliver applicants who have the skills to succeed. Indeed, nonprofit workforce providers will undoubtedly need to do more to make the value proposition clear to employers and become trusted intermediaries.

"It's not enough to say that hiring locally is good," says Enbar. "The key is to show that there's an untapped source of talent right nearby, and hiring those people is the right thing for your business."

Brooklyn needs to put more residents on the path to earning a college credential

Brooklyn's four-year high school graduation rate reached a record high of 76.6 percent in 2018, up from just 60.5 percent in 2009, an improvement that is worth celebrating. But in Brooklyn's growing innovation economy, a high school diploma by itself can only go so far. While jobs in advanced manufacturing and entry-level positions in film and TV production can be obtained with a high school diploma and several weeks

"It's critical to invest in building a diverse workforce when your company is still small."

of hands-on training, many well-paying positions in the innovation economy—from data analyst and software engineer to UX designer and digital marketing specialist—typically require at least some form of postsecondary credential, if not a full four-year bachelor's degree.

Indeed, for Brooklyn to succeed in significantly increasing the number of low-income residents who have access to jobs in the innovation economy, the borough's leaders will need to take steps to put a lot more Brooklynites on the path to a college credential. Today, only 35.2 percent of adults in Brooklyn hold a bachelor's degree or higher, and many of Brooklyn's college graduates are more recent arrivals from other cities. In contrast, the share of adults with at least a BA is considerably higher in Manhattan (60.7 percent) and in many of the other cities which are vying for pre-eminence in the innovation economy, including Boston (47.4 percent), Austin (49 percent), San Francisco (55.8 percent), and Seattle (61.7 percent).

College attainment rates are considerably lower in many Brooklyn neighborhoods, including Brownsville (where 13.6 percent of adults have a BA or higher), East New York (14 percent), Canarsie (18.6 percent), Sunset Park (19 percent), and East Flatbush (22.5 percent).

Moreover, there are significant racial and ethnic disparities in college attainment levels across Brooklyn. Whereas 54 percent of non-Hispanic whites in the borough have at least a bachelor's degree, the rate is just 33.1 percent for Asians in Brooklyn, 22.7 percent for Black residents, and 16.9 percent for Hispanic or Latino Brooklynites.

Boosting these numbers will require a long-term effort, and significant investment. But the massive improvements in high school graduation rates in Brooklyn and across the city show that major educational gains are possible.

Brooklyn's CUNY campuses must play a bigger role in developing a pipeline of talent for innovation companies

Brooklyn's four CUNY colleges will be critical to efforts to boost the number of Brooklyn residents with a college credential. These institutions— City Tech, Brooklyn College, Medgar Evers, and Kingsborough Community College—serve more than 57,000 students annually, including full-time, part-time, and graduate students. These colleges are already helping students from lower-income backgrounds springboard to the middle class and, in a growing number of instances, into the innovation economy. For instance, graduates of City Tech have the highest median earnings one year after graduation of all CUNY colleges citywide ($41,564).

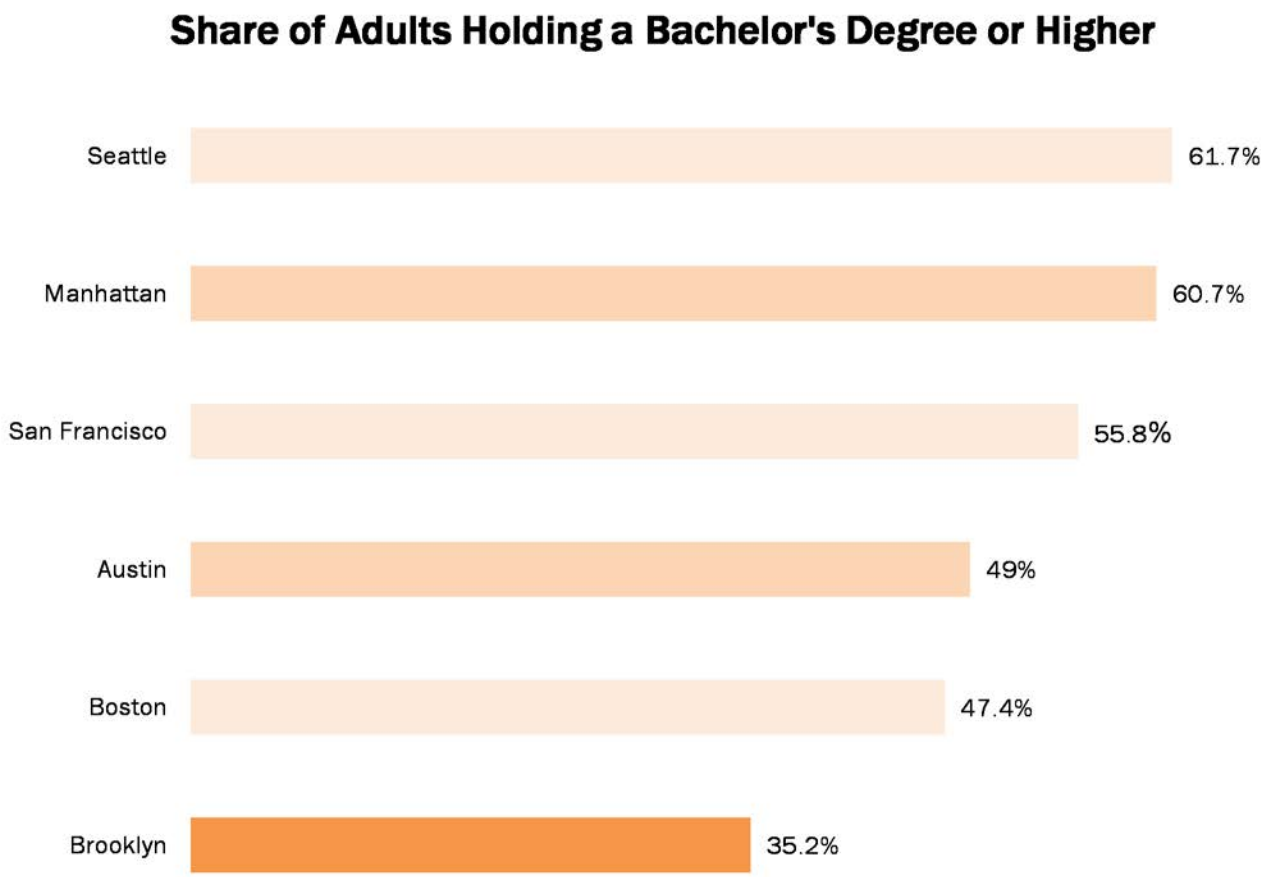
But all four Brooklyn-based CUNY institutions could benefit from additional resources and from investments to more closely align with the needs of employers in the innovation economy. CUNY could undoubtedly benefit from new investments to ensure that more of the students enrolling in its colleges actually earn a credential. Medgar Evers has the lowest six-year graduation rate of any senior college, at just 23 percent. City Tech is the second-lowest, at 26.2 percent. Even at the relatively high-performing Brooklyn College, just 58 percent of students in bachelor's degree programs graduated within six years. (CUNY's system-wide average is 50.8 percent.)[8]

But the borough's CUNY campuses will also need to make progress in aligning their programs with the innovation economy.

Brooklyn's CUNY students lack access to work-based learning opportunities.

To help expose more Brooklyn CUNY students to career paths in the innovation economy, far more students will need access to an internship while in college. But a relatively small share of students is currently able to access one. Last year, fewer than one in five City Tech undergraduates had an internship. At Medgar Evers it was just 15.4 percent and at Kingsborough Community College it was just 10.2 percent.[9]

The challenge stems, in part, from a lack of career-focused resources at Brooklyn's CUNY colleges. The gap is particularly stark at City Tech, where many majors require students to pursue an internship, but fewer than 20 percent of students report landing



Source: CUF analysis of data from the 2013-2017 American Community Survey.

one. The availability of career services is constrained, administrators say, as the college makes do with just three counselors serving the entire population of 17,000 students. Even at Brooklyn College, where the career center is privately funded, developing relationships with employers is an uphill climb. "We don't have the team to have account managers to follow up with 100 companies," says center director Natalia Guarin-Klein.

CUNY has another promising program, CUNY 2X Tech, which set a goal of doubling by 2022 the number of CUNY students graduating annually with a tech-related bachelor's degree. The five-year program is designed to better align tech education with industry needs and expand advising and internship opportunities so students can build real-world experience. The program launched at Hunter College and Lehman College in 2018, but has yet to expand to City Tech or Brooklyn College.

More Brooklyn students could be earning STEM degrees

In 2017, Brooklyn's City Tech produced 1,203 STEM graduates, more than any other CUNY campus. But all of the Brooklyn-based CUNY schools have room to further boost these numbers. For instance, just 11.4 percent of Kingsborough Community College's 2017 graduates earned a degree in a STEM field. At Brooklyn College, just 10 percent of graduates earned a degree in STEM.

Beyond the total number of STEM majors and graduates at CUNY's Brooklyn schools, specific gaps exist in high-demand, high-growth fields. For instance, while CUNY offers programs in data science at City College and John Jay, no Brooklyn campus offers a data science major. Likewise, while John Jay offers a major in computer science and information security, and Bronx Community College has a cybersecurity certificate program, there are no comparable programs offered at any Brooklyn colleges. There are also no engineering

City Tech graduates have the highest median earnings one year after graduation of all CUNY colleges: $41,564.

bachelor's degree programs at any Brooklyn campus: of the 594 bachelor's degrees in an engineering field awarded in 2017, not one was granted at a Brooklyn-based CUNY.[10]

There is also a significant mismatch between the popularity of certain degree programs and the opportunities growing in Brooklyn's innovation economy. For instance, at Kingsborough Community College, three times as many students are currently pursuing an associate's degree in criminal justice as are enrolled in the computer science program (844 vs. 294). Similarly, just 99 students are currently enrolled in the computer science bachelor's degree program at Medgar Evers, compared to 330 in liberal arts and 502 in psychology.

Brooklyn's only community college is far removed from the borough's innovation corridor.

Kingsborough Community College is the only CUNY community college in Brooklyn. With 10,494 degree-seeking students and an additional 4,545 students in non-degree and continuing education programs, Kingsborough provides access to higher education for a diverse mix of Brooklyn residents, most of whom are from low-income families. In fact, fully 70 percent of the college's students come from households earning less than $30,000 annually, and one student in seven is financially supporting children.[11]

For many Brooklyn residents, Kingsborough is the most accessible, affordable option for earning a postsecondary credential and gaining access to a well-paying job. But the college's connections to the borough's innovation economy are limited, in part because the campus is physically disconnected from the parts of Brooklyn where tech, creative, and advanced manufacturing jobs are growing.

Located at the very tip of Manhattan Beach, the campus takes more than 70 minutes to reach by bus and subway from employment hubs like Dumbo or Industry City. One-quarter of Kingsborough students say that commuting to and from campus takes from 11 hours per week to 20-plus hours, among the longest reported commutes of any CUNY community college. In addition, 75 percent of Kingsborough students report spending zero hours participating in internships or other applied learning—the lowest participation rate of any CUNY college.[12] In part, it's the college's physical distance that exacerbates these disconnects, say students and administrators. Closer connections with industry—in particular, the borough's growing tech and creative companies—would allow deans to build academic and certificate programs more strategically, says Sharon Warren Cook, dean of curriculum, instruction, and assessment at Kingsborough Community College. "How do we future proof the academic work if we don't know where we are going," she asks, "If we're not in the room with the tech company?"

To date, Kingsborough has developed a number of partnerships with employers, including a program called CXM Academy to train customer experience managers, with students landing jobs at one of ten industry partners, including National Grid, Con Edison, and TD Bank. The school also recently launched a 15-week program to train students in user experience design, which is run through CUNY's TechWorks initiative and funded by a grant from the U.S. Department of Labor. Each cohort has 25 students; the top nine get a paid internship with a set of employer partners who commit to interviewing students for full-time positions at the end of the term. But developing partnerships with smaller but fast-growing companies in Brooklyn's innovation industries remains a challenge.

Share of Undergraduate Students at CUNY's Brooklyn Colleges Who Participated in an Internship, 2018

College	Internship Percentage, 2018
Brooklyn College	23%
City Tech	19.4%
Medgar Evers	15.4%
Senior College Avg.	21.7%
Kingsborough	10.2%
Community College Avg.	10.8%

STEM Degrees Granted at CUNY's Brooklyn Colleges, 2017

College	STEM Degrees Granted	Total Degrees Granted	% STEM Degrees
City Tech	1,203	2,711	44%
Medgar Evers	393	1,130	35%
Brooklyn College	383	3,824	10%
Kingsborough	296	2,590	11%

How Brooklyn Develops Talent Today

Brooklyn is home to more than 400 public K–12 schools and four CUNY campuses, as well as more than two dozen workforce development organizations operating over 100 programs.

The borough's four CUNY schools—Brooklyn College, Medgar Evers, CityTech, and Kingsborough Community College—serve more than 57,000 students annually, including full-time, part-time, and graduate students. City Tech, in particular, plays a key role in preparing Brooklyn residents for jobs in the innovation economy. In 2017, City Tech granted 1,203 degrees in STEM fields—more than any other college in the CUNY system. Kingsborough is only of only three community colleges to offer CUNY TechWorks, a free 15-week course developed with industry professionals to teach UX design. Brooklyn also benefits from several other institutions of higher education, including NYU Tandon School of Engineering, St. Francis College, and LIU Brooklyn, all located in Downtown Brooklyn; and the Pratt Institute and St. Joseph's College, both in Clinton Hill.

Brooklyn's 93,000 students in grades 9 through 12 are served by 120 public high schools, including 31 that offer CTE programs. Brooklyn has added 14 new CTE programs since 2016—more than any other borough—including several aligned with opportunities in the innovation economy. These include three new programs in web and digital media communications, two programs in digital arts, and three in pre-engineering. In addition, the new Brooklyn STEAM Center at the Brooklyn Navy Yard takes students from eight local high schools and provides hands-on instruction in one of five career pathways: design and engineering; computer science and information technology; film and media; construction technology; and culinary arts and hospitality.

Brooklyn is also home to two of New York City's seven Pathways in Technology Early College High School (P-TECH) schools, including the eight-year-old P-TECH in Crown Heights and the City Polytechnic High School of Engineering, Architecture & Technology in Downtown Brooklyn. These six-year high schools prepare students for college and STEM careers while allowing students to earn college credit at no cost.

In addition, Brooklyn has more than two dozen nonprofit workforce development organizations and skills-building providers, including Opportunities for a Better Tomorrow (OBT), Brooklyn Workforce Innovations (BWI), Per Scholas, NPower, and Access Labs. Although relatively few of Brooklyn's workforce development programs are specifically focused on career opportunities in the innovation economy, there are several strong examples.

For instance, OBT's TechSTART program, offered at the Industry City–based Innovation Lab, provides participants ages 17 to 24 with a 12-week immersion in cloud support engineering and cloud storage management. The Innovation Lab also offers employment services to a broad mix of businesses located within the complex. Further up the Brooklyn coast, BWI's five-week Made in NY production

assistant training program, based at the Brooklyn Navy Yard, helps about 80 low-income New Yorkers each year gain access to entry-level production jobs in the growing film and TV industries. The Brooklyn Navy Yard also runs an in-house employment center, which helped companies make nearly 600 hires in 2019, of which 84 percent were from Brooklyn, and about half had no more than a high school degree or equivalency. The Brooklyn Army Terminal, operated by the city's Economic Development Corporation, has two programs aimed at developing talent for local companies: BAT Training Lab and the Workforce1 Industrial & Transportation Career Center. Together, these three campuses are among the only examples of place-based workforce development programs in Brooklyn—programs that embed training within a major cluster of local businesses.

Brooklyn also has a small number of larger training providers focused on preparing Brooklyn residents for tech careers. Per Scholas, a national nonprofit training provider for technology careers, opened a Brooklyn location in 2016. The organization offers a 16-week cybersecurity training course developed through a partnership with Barclays, and is currently serving about 100 people per year in Brooklyn. Access Labs, a coding bootcamp created by WeWork and Flatiron School, takes a different approach. The program charges tuition for its 15-week bootcamp for aspiring software engineers, which is deferred until after a student lands a job. Since starting in early 2018, Access Labs has graduated more than 90 students from its Dumbo-based program.

Brooklyn has other resources to draw from in expanding access to the innovation economy. For example, Brooklyn Public Library's Brooklyn Robotics League—developed in partnership with NYC First—is the city's first borough-wide robotics competition, and is open to kids ages 9 through 17. Brooklyn's branch libraries offer a number of other tech-skills and STEM-enrichment programs, including Today's Teens, Tomorrow's Techies (T4), which trains teens to help library patrons use technology while earning stipends and community service credit.

Brooklyn's Tech Education and Training Ecosystem

Brooklyn is home to more education and training programs that prepare New Yorkers for careers in technology than any borough other than Manhattan. According to a Center for an Urban Future analysis Brooklyn is home to 122 of the 378 program locations citywide that offer K-12 programs in tech education (32 percent) and 107 of the city's 467 adult tech training program locations (23 percent). However, there are also programming gaps, geographic disparities, and capacity challenges that limit the effectiveness of the efforts in Brooklyn—and citywide—to diversify the tech workforce.[13]

Findings of our research include:

- Brooklyn is home to 22.9 percent of sites offering adult tech training programs citywide. This is well behind Manhattan (45.0 percent), but ahead of Queens (20.3 percent), the Bronx (10.7 percent) and Staten Island (1.1).

- Every neighborhood in Brooklyn has at least one site offering adult tech training programs, but four of the borough's 18 Census-defined neighborhoods have just one program location: Brownsville/Ocean Hill, Bensonhurst/Bath Beach, East Flatbush/Farragut/Rugby, and Bay Ridge/Dyker Heights.

- One neighborhood—Brooklyn Heights/Fort Greene—is home to more than 40 percent of all adult tech training programs in the borough. Brooklyn Heights/Fort Greene has 43 sites offering adult tech training programs—behind only Soho/Battery Park City/Greenwich Village (with 60) and Midtown/Chelsea (58).

- Only one other Brooklyn neighborhood has more than 7 sites offering adult tech training programs—Bedford-Stuyvesant (with 12). Park Slope/Carroll Gardens/Red Hook has the third most adult tech training programs (7), followed by Prospect Heights/Crown Heights North (6), Sheepshead Bay/Gerritsen Beach/Homecrest (6), Prospect Lefferts/Wingate/Crown Heights South (5), Bushwick (4), Borough Park/Kensington/Ocean Parkway (3), Flatbush/Midwood (3), East New York/Starrett City (3), and Canarsie/Flatlands (3).

- Brooklyn is home to 32.3 percent of the sites offering K-12 tech education programs citywide. This is behind Manhattan (47.9 percent), but well ahead of Queens (9.8 percent), the Bronx (8.5 percent) and Staten Island (1.6).

- Six of the 18 neighborhoods in Brooklyn have two or fewer sites offering K-12 tech education programs: Bensonhurst/Bath Beach and Sheepshead Bay/Gerritsen Beach/Homecrest each have none; East Flatbush/Farragut/Rugby and Bay Ridge/Dyker Heights both have one, while Canarsie/Flatlands and Prospect Heights/Crown Heights North each have two.

- Park Slope/Carroll Gardens/Red Hook leads Brooklyn with 28 sites offering K-12 tech education programs. This is the third most citywide—behind only Soho/Battery Park City/Greenwich Village (with 34) and Midtown/Chelsea (32). Brooklyn Heights/Fort Greene has the second most K-12 tech education programs in the borough (with 17), followed by Williamsburg/Greenpoint (16), Sunset Park/Windsor Terrace (15), Bushwick (8), Prospect Lefferts/Wingate/Crown Heights South (7), Brownsville/Ocean Hill (5), Flatbush/Midwood (5), Borough Park/Kensington/Ocean Parkway (4), and East New York/Starrett City (3).

RECOMMENDATIONS

Strengthen Brooklyn's unique position as a driver of New York City's innovation economy

- **Launch a growth plan for Brooklyn's innovation economy**. To build on Brooklyn's competitive edge in the innovation industries and head off looming challenges, policymakers and local leaders should launch a comprehensive growth plan with specific funding to tackle five key needs: closing Brooklyn's borough-wide and regional transit gaps; unlocking space for jobs through land use changes; aligning incentives and tax policy to spur job creation; investing in public space improvements and cultural infrastructure; and expanding Brooklyn's workforce training and education systems to develop more local talent and create opportunities for far more residents from low-income communities.

- **Launch a major campaign to prepare 25,000 Brooklyn residents for careers in the innovation economy by 2025.** Brooklyn's growing advantage in tech, the creative industries, and advanced manufacturing is poised to generate thousands of well-paying jobs in the years ahead. But to ensure that these jobs are accessible to far more Brooklyn residents from lower-income communities, New York City and borough leaders will need to launch a major new effort to provide Brooklynites with the education, skills training, and connections needed to succeed. Brooklyn should take multiple approaches to meet this ambitious goal, including by boosting the number of students at Brooklyn's CUNY colleges who graduate with degrees in STEM fields; vastly expanding the number of Brooklyn residents who complete in-depth job training programs in innovation economy industries; increasing the number of high school vocational programs in tech, creative industries, and advanced manufacturing; growing the number of employers in innovative industries who offer paid internships and on-the-job training; and launching new apprenticeship programs in Brooklyn's tech and creative industries.

Boost the borough's transit infrastructure

- **Improve transit service for people commuting within the borough**. Brooklyn's greatest competitive advantage in the innovation economy is its highly educated workforce, but currently many of the borough's residents find it far easier to commute to jobs in Manhattan. City economic development officials—as well as leaders in Brooklyn—should push for new investments that greatly improve transit service between the North Brooklyn neighborhoods that are home to so many people working in the tech and creative industries and the communities further south where a disproportionate share of the innovation economy jobs are being created—including the Navy Yard, Dumbo, Downtown Brooklyn and Sunset Park. This means supporting the Brooklyn-Queens Connector streetcar (BQX), but it should also include improvements that increase the frequency and speed of bus service in the borough.

- **Upgrade Brooklyn subway stations serving major job hubs.** Dumbo has become one of the city's most appealing destinations for innovation economy companies, but the neighborhood could greatly benefit from improvements to its main subway station at York Street. There is a mounting need to add capacity and address congestion issues at the station, where weekday ridership has more than doubled in the past decade. The station currently has just one exit, so adding a new one closer to its southern end would provide much needed relief. In addition, several other stations that serve the borough's growing job centers are badly in need of repair and face serious capacity issues, including Borough Hall, Jay Street, and Hoyt Street stations.

- **Add ferry service connecting Brooklyn and New Jersey**. To continue growing its innovation economy and attract larger innovation companies, Brooklyn will need to make it easier for workers living in Jersey City, Hoboken, and other communities outside of the city to commute to jobs in the borough. This is because larger companies draw its workforce from throughout the region. One solution is to add a direct ferry connection between Brooklyn and New Jersey, something that does not exist today. Brooklyn policymakers should push NYCEDC, DOT and private ferry operators to launch ferry service connecting New Jersey with Dumbo, Sunset Park, and Williamsburg.

- **Maintain expanded G train capacity to meet growing demand**. To help alleviate crowding during repairs to the L train tunnel, New York City Transit has expanded the capacity and frequency of the G train. This includes both additional roundtrips on weekdays and longer trains to accommodate more passengers. Given the growing demand for G train service, which is helping connect Brooklyn residents to major job centers within the borough, New York City Transit should maintain this expanded service permanently to help meet the demand. G train ridership has seen strong growth since 2013, increasing more than 20 percent across several stations served only by the G train.

- **Prioritize connections to current and emerging job hubs through the Brooklyn Bus Network Redesign.** Over the next year, New York City Transit is developing a plan to redesign the Brooklyn bus network, with the goal of improving speed, reliability, and capacity; closing coverage gaps; bolstering off-peak service; and eliminating redundancy. To ensure that this process results in substantial improvements to bus service across the borough, the redesign should prioritize better connections to Brooklyn's existing and emerging job clusters along the corridor from Sunset Park to Williamsburg and faster transit times from the neighborhoods where Brooklyn's workforce lives—many of which are in north Brooklyn—to the neighborhoods where jobs are growing.

- **Permanently adopt the MTA's Atlantic Ticket pilot program to foster connections between Brooklyn and Queens.** The MTA's highly successful Atlantic Ticket pilot program allows riders to travel from seven Long Island Rail Road stations in Queens to Atlantic Terminal in Brooklyn for a discounted $5 fare—less than half the current peak cost. During the first year of the pilot, customers took more than 1.3 million trips using the Atlantic Ticket, which significantly improves commute times for Queens residents with jobs in Brooklyn. The MTA should make this successful pilot program permanent and maintain better connections between Queens and Brooklyn.

Expand the supply of spaces needed to grow Brooklyn's innovation economy

- **Promote new office development by increasing commercial FAR in Dumbo, Downtown Brooklyn, and other areas where it is appropriate**. Dumbo has become one of the city's most attractive centers for the innovation economy and Downtown Brooklyn has enormous potential as a central hub for companies from across the region. But despite record demand and extremely low vacancy rates, relatively few new office developments have moved forward. This would likely change if the city increased the permitted Floor Area Ratio (FAR) in the district to allow greater densities—not for housing or retail, but for commercial and industrial uses.

- **Preserve the borough's Class B & C office spaces**. Many of the city's tech start-ups and creative firms today rent space in these older office buildings, which tend to command sharply lower rents than Class A office towers. Unfortunately, many of the borough's B and C buildings have been converted for other uses in recent years. Borough leaders should take steps to hold onto remaining B & C buildings. This might include supporting new tax exemptions or low-cost financing for tenant improvements that would make it financially attractive for Class B and C owners to preserve their buildings as office spaces.

- **Relocate municipal uses with low job-generating benefits out of innovation districts**. Commercial vacancy rates are hovering near zero in many of the borough's most desirable innovation hubs, but some of these districts are home to government uses that take up large amounts of space. By relocating some of these uses, policymakers could free up more space for high-wage innovation jobs. This might include the Brooklyn Tow Pound that is located inside the Navy Yard; 345 Adams Street in Downtown Brooklyn, which includes storage facilities for the Board of Elections; the Metropolitan Detention Center in Sunset Park; Department of Education buildings at 65 Court Street and 131 Livingston Street; and the Department of Health facility at 295 Flatbush Avenue Extension.

- **Preserve Wallabout as a home for innovation economy companies**. Wallabout, the neighborhood adjacent to the Brooklyn Navy Yard, is home to a number of industrial buildings that are ideal for growing innovation companies—including manufacturing, tech and creative businesses working at the Navy Yard that require more space to grow. But many of the buildings in Wallabout are facing mounting pressure to be converted to housing. The Department of City Planning should consider Wallabout for a rezoning that requires manufacturing but also allows for additional overbuild density for office and residential.

Continue Incentives that help attract innovation companies to Brooklyn

- **Reauthorize REAP**. Many of the innovation companies located in Brooklyn today told us that they may not have moved to the borough if not for REAP, an incentive program that provides a $3,000 business income tax credit for companies relocating jobs from outside of New York City or below 96th Street in Manhattan to designated locations above 96th Street in Manhattan or in one of the other four boroughs. Failure to renew this program will make it difficult for Brooklyn to build on its competitive advantage in the innovation economy and attract new companies from Manhattan and other cities. Leaders from the borough and City Hall should advocate for the reauthorization of the REAP incentive program—and the state legislators based in the borough should support reauthorization.

Maintain Brooklyn's creative edge

- **Launch a Cultural Infrastructure Plan for Brooklyn**. Brooklyn's unparalleled concentration of working artists, musicians, and creative venues has been vital to the rise of the borough's innovation economy. But today, many of the borough's artists are struggling to survive amid rapidly rising real estate costs. To address the challenges threatening Brooklyn's artists and venues, New York City should consider taking a page from London, where Mayor Sadiq Khan recently unveiled an ambitious blueprint to sustain and grow the city's cultural infrastructure. City officials should do the same for Brooklyn, which has become the heart of New York's emerging creative ecosystem. Such a plan might include establishing Creative Enterprise Zones, which in London are funding the creation of affordable workspaces for artists and creative businesses while also developing training programs that help local residents access jobs in the creative economy.

- **Expand Spaceworks NYC across Brooklyn's innovation clusters.** The nonprofit Spaceworks NYC has proved effective at creating affordable spaces for visual and performing arts. It has built arts spaces in Williamsburg, Gowanus and Park Slope, but Brooklyn stakeholders should explore partnerships that bring Spaceworks NYC to innovation centers like Dumbo, Downtown Brooklyn, and Sunset Park.

Build community around Brooklyn's innovation economy

- **Establish a Brooklyn Innovation Industry Council**. Brooklyn has emerged as one of the nation's leading hubs of the innovation economy, but the borough's more than 1,000 innovation companies don't always speak with a strong voice. Brooklyn would benefit from an innovation industry council that would regularly pull together leaders from the borough's innovation industries to discuss, strategize, and advocate on critical issues affecting the sector's sustainability and growth—from improving transit to expanding internships. The council

should be led by founders and executives from Brooklyn-based innovation companies, with representation from tech, creative and advanced manufacturing businesses located across the borough. Brooklyn Borough President Eric Adams and the borough's City Council delegation should consider providing seed funding to launch the council.

- **Develop an annual Brooklyn Innovation Awards competition**. Establishing an awards competition for companies and products in tech, creative industries, and advanced manufacturing would help raise the visibility of Brooklyn's high-flying innovation economy and showcase some of the innovative companies in the sector.

- **Launch an accelerator in Brooklyn focused on one of the borough's emerging competitive strengths**. Although Brooklyn is home to dozens of incubators and co-working spaces, our research found that the borough could use more step-up offices with flexible and affordable leasing terms. To address this need, Brooklyn policymakers should work with NYCEDC to establish an accelerator space focused around one of the growing industries where the borough holds a competitive advantage, such as fintech, property tech, digital health, consumer electronics, or gaming.

Expand access to jobs in Brooklyn's innovation economy

- **Boost the number of low-income Brooklyn residents with a college degree.** Low levels of formal educational attainment are preventing thousands of Brooklyn residents from accessing the borough's growing number of well-paying jobs in innovative industries. While 61 percent of adults in Manhattan have at least a bachelor's degree, the same is true for just 35 percent of Brooklyn residents—with significantly lower levels in most of the borough's lower-income communities. To ensure that more Brooklynites can access the borough's growing supply of well-paying jobs, the city and state, along with CUNY's leadership, should double down on efforts to boost graduation rates. Programs like CUNY ASAP that are proven to increase completion rates at community colleges should be expanded to reach every community college student, and similar programs should be developed and launched at the borough's senior colleges—particularly at Medgar Evers, which has the lowest six-year graduation rates of any senior college. The New York City Department of Education should set a goal of boosting college readiness rates for Brooklyn's high school students from 50 percent to 75 percent by 2025, while ensuring that the borough's lowest-performing schools are making gains.

- **Increase the number of black and Hispanic STEM graduates in Brooklyn.** Brooklyn has benefited from a strong push by CUNY in recent years to increase the number of programs offered in STEM fields. But to ensure that more Brooklyn residents from low-income communities are able to access the best-paying jobs in the borough's innovation economy, far more Brooklynites should be earning STEM degrees. Brooklyn's City Tech produced 1,203 STEM graduates in 2017—more than any other CUNY campus. But Medgar Evers, Brooklyn College, and Kingsborough Community College are collectively producing just 1,072 STEM graduates each year. In addition, students who are black and/or Hispanic, and/or who are women, remain seriously underrepresented among STEM graduates. Working with partners at CUNY and the DOE, at community-based organizations, and at other educational institutions, Brooklyn should set a goal to increase the number of STEM graduates at Brooklyn's public colleges by 50 percent and launch new mentorship and early-exposure programs to help grow the share of Brooklyn STEM graduates who are black and/or Hispanic, and/or who are women.

- **Build community job training and employment hubs in neighborhoods where Brooklyn's innovation industries are growing.** Job opportunities in Brooklyn's innovation economy are growing rapidly, but relatively few physical spaces exist to connect local residents with area employers and industry-guided training. The city should provide seed funding for the development of new Innovation Job Centers in neighborhoods like Dumbo, Downtown Brooklyn, Williamsburg, and Bushwick—developed in partnership with

local nonprofits and commercial landlords—to embed local recruitment and training programs amid clusters of innovative businesses.

- **Expand the city's ApprenticeNYC initiative to include apprenticeship programs in Brooklyn's tech and creative sectors.** New York City's recently launched ApprenticeNYC program aims to create 450 apprenticeships in the industrial, health, and tech sectors by 2021. For New Yorkers with limited formal education, this program can provide a powerful economic boost, while offering employers a way to develop talent with the exact skills they need. But so far the initiative is operating at a very small scale. While this is an important start, the city should move quickly to launch new apprenticeship programs in other parts of the innovation economy, including in tech and creative occupations. Apprenticeships in data science and marketing, software development, or cloud computing could create important new pathways into Brooklyn's innovation economy, while helping more companies meet hiring needs and boost retention while diversifying their workforces.

- **Develop new capacity-building grants so Brooklyn's nonprofit job training organizations can launch and scale programs focused on the innovation economy.** Brooklyn benefits from a number of well-regarded job training and skills-building organizations focused on careers in the innovation economy, but there are too few of these programs overall and the scale remains very small. Research conducted for this report found that fewer than 300 Brooklyn residents are graduating from free, in-depth tech training programs annually, and programs aimed at jobs in the creative industries are smaller still. New York City should support capacity-building grants designed to help organizations scale the programs that are working, including by building new training facilities and hiring instructional, administrative, and outreach staff. In addition, this initiative should support the growth and development of nonprofit small-business intermediaries that can help convene local employers with training organizations to identify talent needs and build industry-informed curricula.

- **Fund bridge programs in Brooklyn to provide on-ramps to further education and job training.** Brooklyn has very few bridge programs designed to connect residents with significant barriers to employment—like limited English and math skills and no high school diploma—to in-depth job training and further education. For nearly one million Brooklynites, including 340,000 adults without a high school diploma or equivalent and 565,000 residents who speak English less than very well, training programs for jobs in the innovation economy are often out of reach. To ensure that far more Brooklyn residents can connect with career-oriented training and education, the city should invest at least $70 million annually in bridge programs citywide and greatly expand the number of programs bridging into advanced training programs for the innovation economy.

- **Build the capacity of Brooklyn's CUNY colleges to connect with innovative employers.** CUNY's Brooklyn colleges play a vital role in producing STEM graduates with the skills and credentials needed to access jobs in the borough's innovation industries. But research for this report finds that too few of Brooklyn's CUNY schools are connecting with employers in the borough's innovation economy. In part, this problem stems from a lack of capacity: for instance, City Tech has just three career counselors serving the entire population of 17,000 students. The challenge is exacerbated by the fact that most of the borough's tech start-ups, creative companies, and advanced manufacturers are small, which makes the employer outreach process much more labor-intensive. To help CUNY develop relationships with a much larger pool of local employers in the innovation economy, the city and state should support a significant expansion of CUNY's career services departments and ensure that more counselor and account managers are hired at each college.

- **Relaunch and expand the Brooklyn Tech Triangle Internship program.** The Brooklyn Tech Triangle Internship program, which launched in 2012, offered City Tech students a nine-week paid internship with companies

in Brooklyn's innovation economy, receiving accolades from both businesses and students. But funding for the program, which was provided by the Department of Small Business Services and the Mayor's Office of Media and Entertainment, along with members of the Brooklyn Tech Triangle, ended in 2017. The program should be relaunched and expanded to include both high school and college summer internships, with additional support from the Department of Education, and grow to include at least 300 internships per year with innovation economy companies located throughout Brooklyn.

- **Expand high school CTE and work-based learning programs aligned with the innovation economy.** Brooklyn's CTE programs provide an important pathway for high school students to access job-specific training and work-based learning opportunities. However, far too few of Brooklyn's current CTE programs are aligned with occupations in the innovation economy. For instance, Brooklyn has just one CTE program in web design, at the Academy of Innovative Technology High School in Cypress Hills, and the new Brooklyn STEAM Center offers the borough's only CTE program in computer science. The Department of Education should launch at least ten new CTE programs in fields such as data science, e-commerce, media production, construction technology, and advanced manufacturing, and ensure that every CTE school has at least one program focused on computer science.

- **Embed more high school programs in innovative workplaces.** For most Brooklyn high school students, their first experience in the workplace is a minimum-wage job in the service sector. While these experiences are valuable on their own, Brooklyn has an enormous opportunity to greatly expand the availability of work-based learning experiences aligned with the borough's fast-growing innovation economy. One highly promising model is the Brooklyn STEAM Center at the Brooklyn Navy Yard, which provides hands-on exposure to real jobs and workplaces in technology, manufacturing, and the creative industries. The Department of Education should replicate the STEAM Center model in other Brooklyn innovation-economy job clusters, including Industry City and Dumbo, and set a goal of connecting at least 30 high schools to innovative work-based learning opportunities like the STEAM Center over the next three years.

- **Launch new programs designed to recruit more innovation economy employers as partners in developing talent.** Brooklyn's innovation economy companies need to get more involved in hiring locally, helping to develop relevant education and training curricula, creating internship and apprenticeship opportunities, and partnering with schools, colleges, and workforce development organizations. But support is needed to help facilitate relationships between Brooklyn's relatively small innovation-economy employers and local training and education organizations. New York City's Economic Development Corporation should launch a new RFP designed to incentivize partnerships focused on employer engagement, which should include business intermediaries like the Brooklyn Chamber of Commerce and local business improvement districts, as well as local training and workforce development organizations. Measurable results would include growing the number of companies participating in existing training programs, like Opportunities for a Better Tomorrow's TechSTART program and BWI's Made in NY program, as well as launching new training initiatives with first-time employer partners.

- **Add a hiring bonus to the REAP tax credit for employers who source talent through local workforce development programs.** REAP provides a $3,000 business income tax credit per employee for companies relocating jobs in one of the other four boroughs. To ensure that more companies that take advantage of REAP are also incentivized to source talent through local workforce development programs, a $2,000 bonus should be added for companies who hire new employees through a nonprofit workforce development program and retain them for at least a year.

ENDNOTES

1. To examine the racial and ethnic composition of Brooklyn's tech sector, we analyzed 17 tech-specific occupations, such as database administrators, web developers, and computer network architects, using data from the 2017 American Community Survey and employing similar methodology to a 2018 Brookings Institution study and a 2016 U.S. Census Bureau report.

2. Center for an Urban Future analysis of data from the 2013-2017 American Community Survey.

3. CUNY Office of Institutional Research and Assessment. Of the 594 engineering grads at CUNY senior colleges in 2016-2017, zero were at Brooklyn schools. All of the 594 were at City College, Baruch & CSI (and one at CUNY J School).

4. Accenture and Tech:NYC, "Tech NYC Survey," May 2018.

5. CUF analysis of data from the 2013-2017 American Community Survey.

6. Office of the Brooklyn Borough President, "School Technology Survey Report," December 2016.

7. CUF analysis of data from the New York State Education Department, "Approved CTE Programs as of July 2nd, 2019."

8. Ibid.

9. CUF analysis of data from the CUNY Office of Institutional Research and Assessment Performance Monitoring Project Data Book, 2017-2018.

10. CUF analysis of data from the CUNY Office of Institutional Research and Assessment Student Data Book, 2018.

11. CUF analysis of data from the 2016 CUNY Student Experience Survey.

12. Ibid.

13. Center for an Urban Future and Tech:NYC, *Plugging In*, Feburary 2020. These findings are based on CUF's analysis of 506 tech education and training programs identified in our research. Among K-12 programs, our analysis focuses on those operated outside the Department of Education, whether in-school or out-of-school.

Center for an Urban Future

Center for an Urban Future
120 Wall Street, Floor 20
New York, NY 10005

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