

NEW YORK CITY

TRANSFORMING A CITY
INTO A TECH INNOVATION LEADER

Victor Mulas and Mikel Gastelu-Iturri



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EXECUTIVE SUMMARY

Over the last 8 years, New York City has become one of the largest and most vibrant tech startup ecosystems in the world. Today, the city is widely seen as a leading startup hub worldwide. However, this was not something one could have anticipated just ten years ago. At that time, the tech startup community in the city was anecdotal and disorganized. New York was seen as the place to be for corporate jobs in finance, media or advertising, and tech was just supportive to corporate functions. Startups were not synonymous with New York. This all changed in 2008. The financial crisis shocked the city and, in doing so, provided the circumstances for the transformation of the New York startup scene. By 2015, New York accounted for nearly a \$6 billion venture capital investment in startups and had over 14,500 startups (Wall Street Journal, 2016 and Digital NYC, 2016.)

New York provides insights on how startups are impacting city economies, generating new sources of jobs and helping transforming the urban landscape. New York represents a new model of startup ecosystems that is emerging in cities worldwide. Different to Silicon Valley's suburban ecosystem, New York's is urban in nature and well integrated into the local economy and industry base. New York is the prime example of the new urban startup ecosystem model, providing key insights:

> New York's tech startup ecosystem evolved around the traditional local industries of the city (e.g., finance, advertising, media, fashion and health.) This process not only allowed it to retain the very specialized talent from the city at a moment of crisis, but it also increased the competitiveness and innovation of New York's traditional industry base. As more and more startups emerged, competitive pressures forced incumbents to also innovate directly, introduce open innovation processes with startups and absorb startup technology (through acquisition or recruitment).

> The startup ecosystem became a new source of employment, generating jobs directly (i.e., those from startups) and, more importantly, indirectly, through non-tech companies (e.g., the local industry base) employing tech talent (partly due to the disruptive and competitive process described above). This push for tech from the traditional industry base resulted in the highest numbers of new sources of employment generated by the ecosystem. Interestingly enough, these new sources of employment provide job opportunities for both low- and high-skilled tech workers.

> The growth of the startup ecosystem further attracted tech R&D, innovation and product development functions from leading tech companies from outside the city (e.g., Google, Facebook, IBM), supporting the economic diversification of New York City and creating new market categories for existing and new industries.

> The startup ecosystem has had significant implications on urban transformation, helping to regenerate neighborhoods in Manhattan and most noticeably, in Brooklyn.

There were many factors that enabled New York's ecosystem to grow; in what for the most part started as an organic process, yet the city, through the New York City Economic Development Corporation (NYCEDC) and the Mayor's office played a critical role supporting the ecosystem with a targeted policy program.

New York remains distinguished in many ways as a city, as was the processes that lead to the growth of its tech ecosystem. Nonetheless many of the challenges it faced when developing the tech ecosystem are similar to those confronted by many other cities. These include: a) lack of technical talents, b) lack of available seed finance, c) limited affordable space for entrepreneurs, and d) a small and decentralized community.

These challenges were addressed through a two-fold approach, combining an overall strategy from the Mayor's office and an operational program of policies developed and implemented by NYCEDC. The program tackled these identified challenges, implementing new solutions through rapid testing, developing the support infrastructure required by the ecosystem, and growing the startup community and attracting key outside resources (e.g., capital, talent and expertise). This included, inter alia: a) creating a network of coworking spaces and incubators, b) developing a university tech education campus in the city, c) catalyzing the seed investment funds, and d) promoting the community and attracting outside tech talent and companies.

The policies that were applied to each of these challenges as well as other supportive actions present examples to learn and inspire other policymakers. This does not mean that these policies could be directly applicable to other environments. However, there are key lessons that we can extract in each of these instances that can help develop policy action elsewhere:

- > The policy program was tailored to New York's identified challenges and it was codeveloped and supported by a coalition of partners that went beyond the Government of New York City itself, involving the whole ecosystem.
- > There was a clear support from the Mayor's office, who took a key role in empowering the community and promoting the local ecosystem to attract needed outside talent and resources.
- > Policies were focused in areas where there was a market failure and where they could catalyze market solutions that would be sustainable over time.
- > The program addressed the ecosystem as a community and not as a "innovation district." This allowed the ecosystem to expand beyond physical boundaries and grew organically, benefiting multiple neighborhoods of the city.

> The skills pipeline was addressed early on and, although remain a challenge, this allowed for the exponential growth of the ecosystem.

This report provides a detailed study of the case of New York tech startup ecosystem, its growth and characteristics as an urban startup ecosystem, the policies applied by the city of New York to support the growth and sustainability of the ecosystem, and the lessons learnt for other policymakers interested in supporting their startup ecosystems. This case study was conducted throughout 2015, including field visits and interviews with key identified stakeholders from New York's ecosystem (Appendix A).

ABBREVIATIONS

API	Application program interface
CDO	Chief Digital officer
CUSP	NYU Center for Urban Science and Progress
DUMBO	Down Under the Manhattan Bridge Overpass
Edtech	Educational technologies
Fintech	Financial technologies
IPO	Initial public offering
NYC	New York City
NYCEDC	New York City Economic Development Corporation
NYCEF	New York City Entrepreneurial Fund
PPP	Public-private partnership

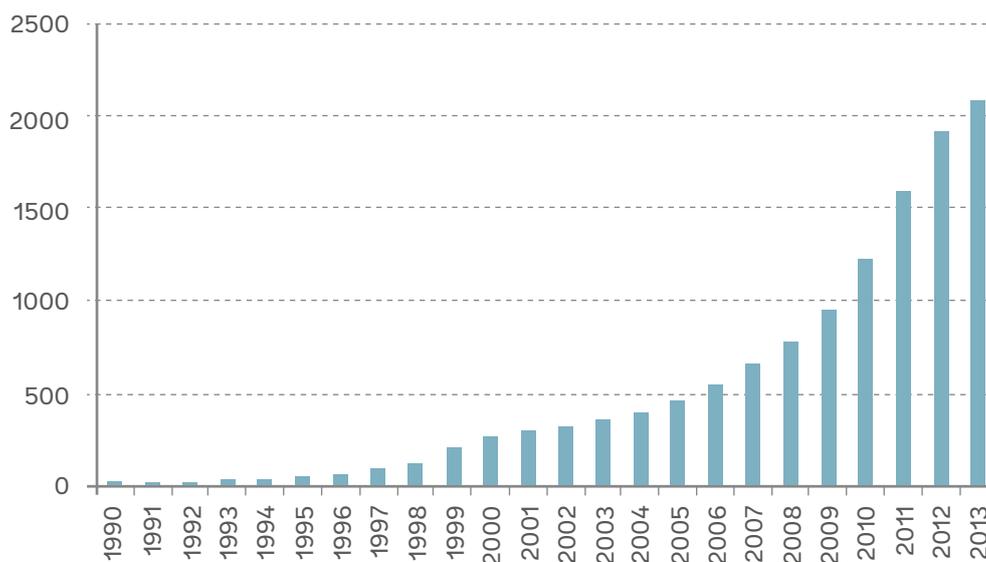
1.

THE GROWTH OF THE TECH STARTUP ECOSYSTEM IN NEW YORK

The city of New York has become host to the second-largest tech startup ecosystem in the United States (after Silicon Valley) with almost \$6 billion venture capital investment in startups in 2015 and over 14,500 startups listed in New York (Wall Street Journal 2016, and Digital NYC 2016). The ecosystem directly employs more than 50,000 people (around one percent of the city's workforce) and generated \$5.6 billion in annual tax revenues for the city by 2014 (about 12 percent of the city's tax income) (Endeavor Insights 2014; and HR & A 2014).

This growth has occurred during the past ten years, with an exponential growth pattern that accelerated after the financial crisis in 2008 (Figure 1.1). Seed investment of venture capital in technology startups increased fivefold since 2003, with over 85 percent of the sector's companies and 86 percent of its employment created during this time (Endeavor Insight 2014).

➤ **FIGURE 1.1. Cumulative Number of Startups in New York**



Note: Actual number of startups in the city is much higher.

Source: As reported to Crunchbase¹ and Angellist² databases (as a proxy of tech startups growth)

The ecosystem has produced **\$18.1 billion in successful exits since 2003**, with over seven initial public offerings (IPO) of companies valued over \$400 million since 2012 (see Table 1.1), and more than 15 acquisitions totaling over \$4.4 billion since 2008 (Endeavor Insight 2014; and CB Insights 2015).

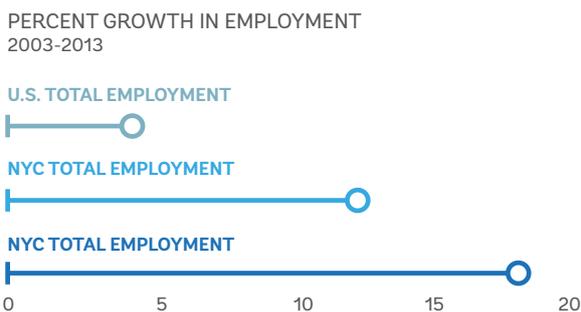
> **TABLE 1.1. Tech Startup IPOs since 2008**

Company	Year	Valuation (MM \$US)
Etsy	2015	3,500
OnDeck	2014	1,320
Everyday Health	2014	416
Borderfree	2014	488
Varonis Systems	2014	524
Tremor Video	2013	494
Shutterstock	2012	558
TOTAL		7,300

Source: News reports (See Appendix B for detailed sources)

Since 2008, employment in the tech startup ecosystem has grown at an annual rate of 18 percent (see Figure 1.2), compared to an overall growth in the city of 12 percent (HR & A 2014).

> **FIGURE 1.2. Comparison of Employment Growth Rate in New York Tech Ecosystem with City and National**



Source: HR & A, 2015.

The New York tech ecosystem has developed a comprehensive infrastructure to support tech entrepreneurs, providing tailored services and fostering a community. Since 2008-09, the city has created mentorship programs, accelerators, incubators, coworking spaces, events, skills training programs, and other supporting services. Today there are over 30 accelerator or incubator programs in the city. With a typical class of 10-12 startups per cohort in these programs, the city graduates over 300 startups per year from these programs alone. Entrepreneurs in New York have access to cheap office space in more than 238 shared office locations. In addition, there are over 40 managed coworking space locations, which create communities of entrepreneurs and provide support services to startups in multiple areas of the city. In 2014, WeWorks, the largest coworking space provider, had over 9,000 members, that is, recurrent users of coworking spaces (Table 1.2).

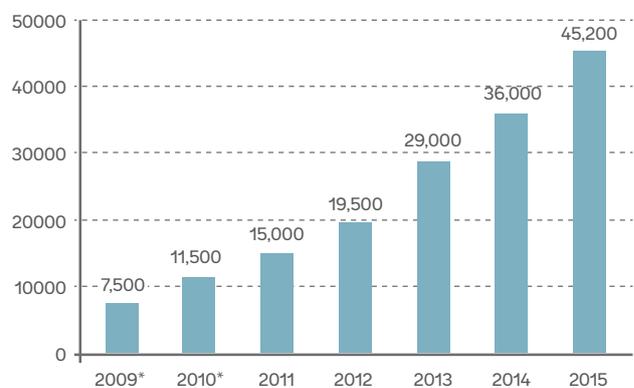
> **TABLE 1.2. WeWorks' Members by Coworking Space Location (2014)**

WeWork Locations 2014	
Company	Members
NoMad	1,442
Fulton Center	1,408
SoHo West	1,307
Charging Bull	1,095
Park South	780
West Broadway	721
Bryant Park	577
Madison	525
Empire State	509
SoHo	488
Meatpacking	389
TOTAL	9,241

Source: Konrad, 2014.

There are numerous tech-related events, hackathons and competitions in the city, reaching a broader audience. New York Tech Meetup³, which is the largest tech event and community in the city, has grown to more than 45,000 members from about 7,000 members in 2009 (see Figure 1.3) (Center for an Urban Future 2012). Angel investors have also grown locally, providing a local base of smart investment and mentorship for early stage startups. New York Angels⁴, the local angel investor association, has invested over \$95 million in entrepreneurship ventures, growing from 30 members at its foundation in 2004 to over 120 in 2015 (New York Angels 2015).

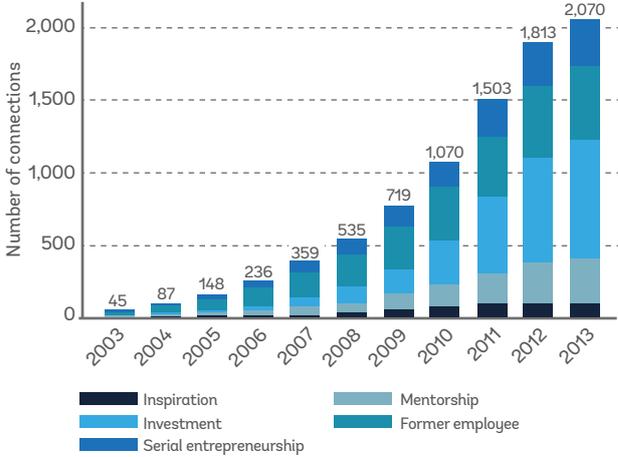
> **FIGURE 1.3. New York Tech Meetup Members per Year**



Note: 2009 data from December 2008; 2010 data from January 2011.
Source: NY Tech Meetup and online news (See Appendix B for detailed sources)

New York’s tech startup ecosystem is deeply connected. This entrepreneurship support infrastructure has resulted in a tight community that supports entrepreneurship in the city organically. There are in-depth linkages among tech startup founders in New York (Endeavor Insights 2014). Connections among founders have grown exponentially, with a substantial increase in investment among tech entrepreneurs, employment among startups, mentorship, and serial entrepreneurs (see Figure 1.4). This growth shows the maturity and sustainability of the ecosystem. Findings by Endeavor Insights (2014) show that mentorship by other top performing entrepreneurs increases the success of startups⁵ in the ecosystem.

FIGURE 1.4. Cumulative Connections Among Entrepreneurs in New York by Type



Note: connections limited to sample of startup founders.
Source: Endeavor Insight 2014.

The growth of the tech startup ecosystem has generated strong demand for technology skills. Since 2011, the city has generated over 15 providers of rapid technology skills in the forms coding of bootcamps, providing the technology skills demanded by the sector. These bootcamp providers graduate over 2,500 students per year (see Table 1.3). These programs are specialized and connected with tech startups and companies to address demand quickly and generate rapid employability for locals (with reporting employment rates on average of 90

percent and above⁶). In addition, New York has gone from having no strong engineering and technical research academic programs to hosting two technology engineering and research programs. New York University created the NYU Polytechnic School in 2014, after merging with the Polytechnic School⁷, and Cornell Tech started courses in the city while it waits for the building of its campus by 2017⁸. With Columbia University, these three schools now produce almost 6,000 engineering and technical graduate students each year⁹.

TABLE 1.3. Bootcamp Providers in New York City

Name	Founded Year	Length of program (weeks)	Est. Yearly Students
Hacker School	2011	12	195
General Assembly	2011	12	750
Dev Bootcamp	2011	19	300
Insight Data Science	2012	6	210
Startup Institute	2012	8	60
Flatiron School	2012	12	60
Make School	2012	9	50
The New York Code and Design Aca	2012	12	51
Startup Institute	2012	8	240
App Academy	2013	9	220
Fullstack Academy	2013	13	150
Turn to Tech	2013	12	NA
Byte Academy	2014	12	240
Metis	2014	12	100
NYC Data Science Academy	2015	12	60
TOTAL			2,686

Note: Estimated number of graduates (based on sessions and class size).
Source: Webpage information and survey to bootcamp providers.

The ecosystem has also attracted large tech companies to establish offices in New York, expanding employment beyond sales functions to core marketing and engineering in search of talent and new ideas. Since 2010¹⁰, tech multinationals have been establishing operational business offices in New York, hosting engineering, marketing, and product development functions. There are more than nine major tech companies with operational offices in New York, employing over 15,000 people (see Table 1.4). These companies are also connected to the tech startup ecosystem, providing support and talent to the ecosystem (for example, Google

has hosted Cornell University’s tech program (Cornell Tech) in its offices while its campus is completed in 2017), and also exit opportunities for startups (for example, Google, Facebook and Yahoo are top acquirers of New York startups¹¹). In addition, employees from these companies are a technically and entrepreneurial savvy source of talent for the tech startup ecosystem, founding their own startups and further boosting the ecosystem¹². New York has also attracted at least two labs from the global research programs of multinational companies: Microsoft Research and Watson Research from IBM, which are part of the innovation ecosystem of the city.

> TABLE 1.4. Large Tech Firms’ New York Offices with Core Marketing or Engineering Functions

	Sq ft total	Estimated employees	Company
2006	281,000	2,081	Google ^a , Facebook
2007	50,000	370	Yahoo ^a
2010	506,000	3,748	Google, LinkedIn
2011	61,000	452	Yahoo, Twitter
2012	35,000	259	eBay
2013	222,000	1,644	Microsoft, Microsoft Research ^b
2014	862,500	6,389	Facebook, Twitter, Yelp, IBM (Watson Research) +, Yahoo, LinkedIn
2015	95,000	704	PayPal
	2,112,500	15,648	

Note: ^a means acquisition of New York startup; ^b means research facility; estimation of employees based on square feet average occupation per employee in tech sector
 Source: Multiple sources (See Appendix B for detailed sources)

The growth and maturity of the tech startup ecosystem have impacted the city’s economy and competitiveness in three main ways: (a) strengthening competitiveness and innovation of local industries, (b) creating new sources of employment and jobs, and (c) contributing to urban transformation.

Strengthening competitiveness and innovation of local industries

New York tech startups have developed around the largest industries of the city (such as finance, advertising, media, fashion, and health) producing innovation for these sectors by introducing new business and operational models and creating new market categories. New York startups are different to pure technology startups. Instead of focusing on technology, the New York startup ecosystem focuses on applying technology to the existing industries and challenges of the city (see Table 1.5) (Center for an Urban Future 2012).

> TABLE 1.5. New York Startups per Sector 2007 - 2012

Sector	Startups founded
Ad Tech	63
Digital Media	121
E-commerce	103
Ed Tech	20
Fin Tech	33
Health Tech	19
Social Networking	79

Source: Center for an Urban Future, 2012.

Since 2011, the city has hosted accelerator programs for many of these categories, where existing firms in the sector interact with startups (see Table 1.6). Barclays Bank and Kaplan manage their own accelerator programs for fintech and edtech start-

ups, resulting in direct access to new innovations. Other accelerators, such as the Fintech Innovation Lab, pair industry professionals assigned by banks with startups.

➤ TABLE 1.6. Thematic Accelerator Programs in New York

Thematic	Accelerator	Year Founded	Startup per cohort
Fintech	Barclays Accelerator	2015	10
	Fin tech Innovation Lab	2014	NA
	Value Street Lab	2011	6
Health	New York Digital Health Accelerator	2012	8
	Blueprint Health	2011	10-11
	Startup Health	2011	NA
Education	EDGE EdTech	2015	12
	Kaplan EdTech	2013	10
Real Estate	Meta Prop NYC	2015	8
Fashion	New York Tech Fashion Lab	2014	8-12

Source: Multiple Sources (See Appendix B for detailed sources)

New York startups have not only introduced technology in the city’s local industries but they have also created new market categories and disrupted existing markets. This disruption is applied locally

and then expanded domestically and internationally. The chart below provides examples of new market categories and business models created by the tech startup ecosystem (see Table 1.7).

➤ TABLE 1.7. Examples of New York Tech Startups Generating New Market Categories

Startup	Sector	New market category business model	Year Founded
Etsy	E-commerce	Handmade and vintage market	2005
Gilt Groupe	Fashion	Low cost fashion	2007
Kickstarter	Finance	Crowdfunding	2009
MakerBot	Manufacturing	Digital manufacturing (affordable 3D printer for consumers)	2009
Quirky	E-commerce, marketplace	Invention platform connecting inventors and companies	2009
Fourthsquare	Urban Living	Search and connect retailers usign mobile	2009
WeWork	Office leasing/real estate	Coworking spaces with community services	2010
General Assembly	Education/vocational training	Tech rapid skills training	2012

Source: Companies’ public information (See Appendix B for more detailed sources)

These new market categories are generating new employment and growth opportunities (see Box 1.1).

BOX 1.1. Etsy's Economic and Employment Impact in New York City

Etsy provides a good example of the impact of start-ups in the city. Etsy was founded in 2005 and has recently exited through an IPO. Its offices have been located in Brooklyn since its foundation and it developed a new market category by creating an e-commerce marketplace for the so-called "maker movement" — handmade goods and craft supplies¹³.

Etsy has had several economic impacts but it is difficult to attribute these precisely to a specific city because of the global nature of its business (31 percent of sales come from outside the United States). In 2013, it had 496 employees of which 347 were in Brooklyn. In 2014, Etsy spent \$52 million on compensation (general and administrative expenses), \$5 million on taxes and \$10 million on capital expen-

diture for website development and property and equipment.

Etsy's growth mirrors the rise of e-commerce start-ups in Brooklyn. From just 73 electronic shopping establishments in 2005, the number had grown to 351 by 2012, an increase of almost 400 percent. Employees increased from just over 400 to 1,576 and payroll increased from \$12 million to \$60 million. With gross merchandise sales of \$1.9 billion and revenue of \$196 million in 2014, Etsy is clearly no longer a startup. It is estimated that Etsy accounted for about 20 percent of employees and a quarter of payroll for the electronic shopping sector in Brooklyn in 2012.

► FIGURE B1.1.1 Brooklyn: Electronic Shopping

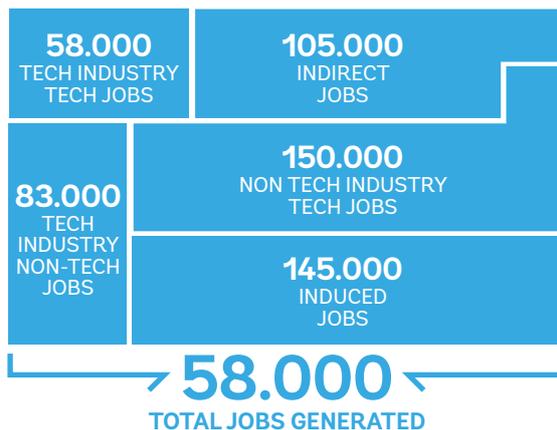


Source: Adapted from U.S. Census Bureau

New sources of employment and jobs

Over the past 10 years, tech startups have generated new direct employment accounting for one percent of the workforce in New York City (58,000 jobs) (see Figure 1.5). However, the impact of the tech sector seems to have expanded to non-tech industries within New York. During this timespan, the city generated 150,000 tech jobs within non-tech industries. An example of these jobs is a web developer in a retailer or a financial institution. Some of these jobs would have been generated in any case because of technology adoption by non-tech companies. However, the focus of startups in the city's traditional business industries strongly suggests that part of the growth in tech jobs in non-tech industries occurred as a response to the disruption of traditional sectors by new business models (see section on "Strengthening competitiveness and innovation of local industries" above). An example of this process is illustrated by the impact of Uber (a startup founded in San Francisco but which rapidly setup offices in New York) in urban transportation. Uber is a platform that allows users to hail taxis and pay for the transaction by a mobile app. Today, in New York, non-Uber taxi companies have developed a mobile app to compete with this new service. Such mobile apps need to be created, maintained, and hosted, generating new tech jobs in non-tech sectors. *These job categories did not exist before the disruptive innovation and are net additions to the job force.*

➤ **FIGURE 1.5 Tech Employment Generated in New York City, 2003 - 2014**

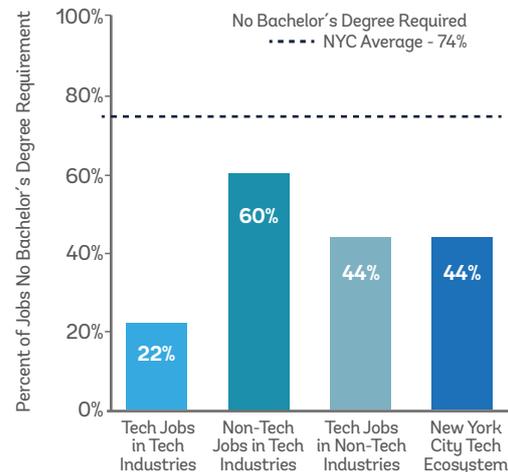


Source: HR & A, 2014.

The jobs created by the tech ecosystem in New York reach beyond typically highly educated workers. Jobs requiring higher education qualifications are core to tech startups and pure tech sector jobs, as they typically require educated and qualified technical talent and entrepreneurship to create disruptive

innovation. However, there is a much broader category of tech jobs, which are more akin to blue-collar tech skills (these include, for instance, jobs involving basic coding of webpages or requiring technical languages). These are tech skills that do not require a bachelor's level degree and can be learnt through rapid skills programs (for example, bootcamps, code academies, and so on) of 10-16 weeks of duration. A third of tech jobs within the tech ecosystem and almost half of tech jobs in non-tech industries do not require bachelor degree level of skills (see Figure 1.6). This has not only spurred the development of a new education industry related to tech skills (see Table 1.3), but also it has expanded the new employment created by the tech ecosystem to the non-highly-educated population, increasing welfare and wealth creation evenly.

➤ **FIGURE 1.6. Tech Employment Where No Bachelor Degree was Required in New York by Category**



Source: HR & A, 2014.

Urban transformation

Tech startups have impacted neighborhoods in New York resulting in urban regeneration. The ecosystem, previously concentrated mainly in Manhattan, has expanded to include boroughs such as Brooklyn (see Figure 1.7). This expansion is the result of the city providing offices at lower rents and in a lower category of office space (Alvarez & Marshal and JRT Realty Group 2013)¹⁴. Tech startups result in the creation of communities in these neighborhoods, resulting in spillover benefits: meetups and events in the neighborhood, use of amenities (e.g., cafes and bars), attraction of related businesses, and so on¹⁵.

➤ **FIGURE 1.7. Map of Startups in New York by Location**

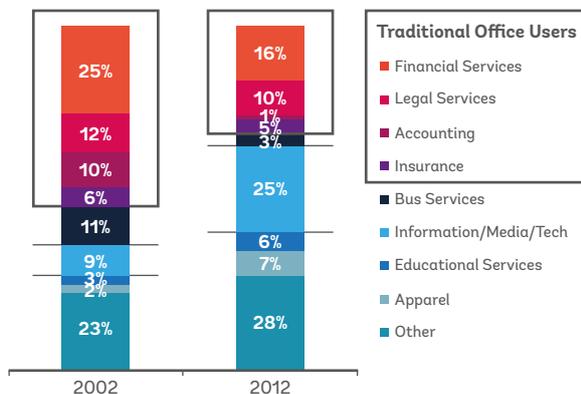


Note: Circles show number of startup reported in the area.
Source: Digital NYC.

As startups have become more successful and have attracted more mature industries, rents have risen, office space has grown, and economic development has increased in areas such as DUMBO and the Navy Yards in Brooklyn. Since 2012, the tech sector has surpassed other categories to become the largest office leasing activity in the city, accounting for 25 percent of office rents (see Figure 1.8).

Brooklyn is an example of the expansion and urban regeneration produced by the startup tech ecosystem, with DUMBO (see Box 1.2) and the Navy Yards being completely transformed into tech hubs in less than 10 years, with over 600 technology and innovation related firms located there. (Brooklyn Tech Triangle 2015). The tech industry is transforming the neighborhood physically, stimulating new developments to attract new firms and particular tenants, as well as economically (see Table 1.8).

➤ **FIGURE 1.8. New York Leasing Activity by Square Feet**



Source: Alvarez & Marsal and JRT Realty Group, 2013.

➤ **TABLE 1.8. Tech Sector Impact in Brooklyn**

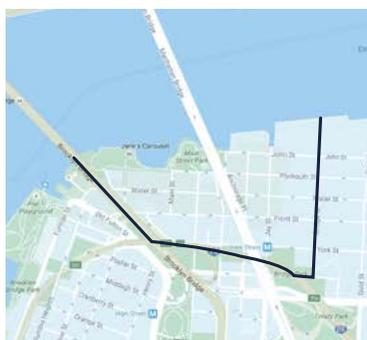
	2012	2015
Tech firms	523	639
Sq Feet of Tech work space (million)	1.7	1.7
Direct tech employees	9,628	17,960
Total economic impact of tech (million US\$)	3,100	5,900

Source: Brooklyn Tech Triangle, 2015.

BOX 1.2. Evolution of Tech Startup Ecosystem in DUMBO

Just across the East River from Manhattan, DUMBO (Down Under the Manhattan Bridge Overpass) forms part of the Brooklyn Tech Triangle (see Figure B1.2.1), an area encompassing 523 innovation firms of which a fifth were launched between 2013 and the beginning of 2014. In addition to DUMBO, the Tech Triangle includes Downtown Brooklyn and the Brooklyn Navy Yard and is home to almost 10,000 tech workers. DUMBO's distinguishing feature is that it comprises a comprehensive tech ecosystem within a few city blocks (about 1.4 square miles (3.6 km²)).

> FIGURE B1.2.1. Map of DUMBO



Source: The New York Times, 2016.

In the early 19th century, the area making up today's DUMBO was a manufacturing and transport hub underpinned by steam ferries crisscrossing the East River¹⁶. High-density brick buildings were built to store, refine, and ship products across the river to Manhattan. The decline of the city's manufacturing in the middle of the 20th century led many companies and workers to leave the area. DUMBO began to experience a renaissance beginning in the 1970s. The riverfront warehouses and high lofts were a big attraction to artists priced out of the Manhattan market. In the late 1990s, tech firms followed, including startups like Big Spaceship and Huge that today employ hundreds of people. Today DUMBO

has carved out a niche as a center for digital advertising¹⁷.

There are 13 universities in Brooklyn with over 90,000 students and a good number of New York's tech workers live in the borough. DUMBO's 54,668 residents (2013) are highly educated with 70 percent aged 25 and over possessing a bachelor's degree or higher¹⁸.

The DUMBO Incubator, supported by NYCEDC and operated by NYU Polytechnic, is located right in the heart of DUMBO's digital district and represents the first incubator space in the area. DUMBO is home to NYC's most prominent media technology and digital companies and, as a result, the DUMBO Incubator has helped spur startup activity in the area. The space is currently home to hardware and digital media companies. There are additional workspace facilities in DUMBO, including options for flexible office space; real estate agency Green Desk has three buildings in the area.

There is a regular and comprehensive program of events in DUMBO organized by startup facilities, special event organizations, and others. The DUMBO Startup Lab Digital has monthly meetups on business model tools and collaborative events with entrepreneurs. Digital DUMBO¹⁹ started in 2009 as a monthly gathering for tech, advertising, and startup companies in the neighborhood. Since then it has organized over 100 live events and conferences that "connect companies and brands with digital tastemakers, talent, and executives", often held at The Dumbo Loft, constructed in 1891 with over 3,200 square feet.

The economic impact of DUMBO and the Brooklyn Tech Triangle is forecast to be \$6 billion in 2015 with almost 18,000 tech workers and 43,000 supporting jobs. Etsy, a startup launched in DUMBO in 2005, is emblematic of tech growth in the district (see Box 1.1).

2.

NEW YORK CITY POLICIES SUPPORTING THE TECH STARTUP ECOSYSTEM

The financial crisis of 2008 was a catalyst for the city to intervene in supporting the growth of the tech startup ecosystem. The 2008 crisis affected the financial sector the most, which represented 38 percent of the private payroll of the city (New York City 2009), and created a recession that impacted all sectors of the economy. During the six months following the financial meltdown, New York City lost nearly 90,000 jobs, two thirds of them outside the finance sector, and by 2009, the consumer spending of New Yorkers had dropped an alarming 11 percent (Fiscal Policy Institute 2009). In response, the city presented a plan of action that would diversify the city economy, promote entrepreneurship, and target industries where New York was seen to have a competitive advantage. The plan, which was the result of a process launched in 2008, resulted in a comprehensive and long-term economic diversification strategy, targeting eight sectors, including bioscience, fashion, tourism, and media and technology, with entrepreneurship (understood as a technological/digital and innovative entrepreneurship) as a cross-cutting asset (NYC Office of the Mayor 2009 and New York City 2009). Whereas the support for sectors to diversify the economy followed a tradition of previous economic plans, the inclusion of technology entrepreneurship was a new departure. This led to a series of specific policies from the city, started by New York City Economic Development Corporation (NYCEDC), to support the tech startup sector.

The City applied a twofold policy approach: (a) practical and operational, led by NYCEDC, and (b) strategic, led by the Mayor's office. NYCEDC was the main actor in designing and implementing key actions towards building the tech sector as the fastest growing one in NYC. NYCEDC conducted a SWOT analysis of NYC's tech startup ecosystem, which informed its set of operational policy actions, most of them following a pilot-testing and scaling-up approach, similar to the lean startup model²⁰ applied by entrepreneurs (see below). In parallel to NYCEDC's scanning of NYC's tech startup ecosystem, Mayor Bloomberg's administration embarked on a comprehensive strategy to digitalize the city that would help the tech startup ecosystem grow in a more favorable environment (see Box 2.1). The Digital Strategy was critical in providing the "official" backing of the city for the tech startup community (which was small but growing at the time) and providing a focal point, the Chief Digital officer, between the community and the city²¹.

BOX 2.1. A Digital Strategy for New York City

In July 2010, the first stone of the digital strategy was placed. Mayor Bloomberg and Katherine Oliver, the newly appointed Commissioner of The Major’s office, launched NYC Digital, a new entity for city-wide digital strategy that would work to engage, serve, and connect the public, making the city government more efficient and citizen-centric (NYC Office of the Mayor, 2011). Its first task would be the development of a thorough report to assess the digital state of the digital, solicit feedback from public and private sectors, and define a *Digital Road Map*, a comprehensive strategy with the goal of making NYC the nation’s leading digital city. To lead this initiative and to further improve the way in which the city was engaging the public through digital technologies, in January 2011 the first Chief Digital Officer (CDO) of the City of New York was appointed.

NYC Digital works closely with other city agencies, such as the Department of Information Technology and Telecommunications (DOITT) and the NYCEDC, to support their initiatives and give advise on digital strategy, policies, and real estate tools. In collaboration with DOITT and the NYCEDC, it also supports

the development of public-private partnerships and developer community relations in the digital media sector, such as in the BigApps initiative or the Made in NY Media Center.

The Roadmap for the Digital City. Mayor Bloomberg and the CDO unveiled the *Road Map for the Digital City* in May 2011 (NYC Office of the Mayor 2011). The report showed the findings of its investigation, providing a comprehensive and strategic plan for NYC’s digital future, presenting both current and future initiatives of various city agencies and organizations towards achieving those goals. The roadmap was divided in five core areas: (1) Access; (2) Education; (3) Open government; (4) Engagement; and (5) Industry. Many of these policies were executed by or combined with the policies of NYCEDC following the operation policy actions to address the challenges identified. By 2013, the progress report showed that all of the targets had been achieved (NYC 2013).

NYCEDC identified key areas to support the growth and sustainability of the tech startup ecosystem in New York City, to which it targeted its policy actions. The SWOT analysis of the tech startup ecosystem identified four main challenges (see Table 2.1)²². This

analysis was conducted through an intensive consultation process with multiple stakeholders representing the ecosystem, including focus groups and open consultations sessions (interview with Dmytro Pokhylko, VP NYEDC).

> TABLE 2.1. Challengers for New York City’s Tech Startup Ecosystem

Challenges	Explanation
1. Lack of physical space for entrepreneurs	Office space in New York City is too expensive for startups and there was no specific offering of office rentals for startup needs.
2. Lack of technology-specialized talent	New York City lacked strong engineering and technical schools and most of the talent was imported.
3. Insufficient seed capital available for local startups	Although New York City was home to many in the VC industry, these firms did not consider New York City startups mature enough for funding.
4. Limited and uncoordinated community of tech-led innovators and entrepreneurs	The tech community was growing but scattered and uncoordinated, there was no robust community infrastructure or institutions, and being an entrepreneurs in New York was socially not considered a respectable occupation.

Source: NYCEDC SWOT analysis. (Interview with Dmytro Pokhylko, VP NYEDC).

Interestingly, these challenges were not unique to New York, which at the time did not have a robust ecosystem, but they were (and still are) common to many other cities that have not traditionally had a tech startup sector. NYCEDC built a program with targeted policies to address each of these challenges where there was a market failure (see Table 2.2). These policies were not part of a large strategic plan and mostly followed a pilot-testing approach, where

the policy was discarded or scaled-up depending on its success, making a better use of public resources and obtaining faster results. In addition, NYCEDC followed a partnership approach with academia and the private sector, which allowed it to: (i) promote the tech startup industry without getting involved in the day-to-day management of the initiatives, and (ii) catalyze further private involvement and the sustainability of the sector in the long term.

➤ **TABLE 2.2. Policy Actions Applied by NYCEDC to Address Identified Challenges**

Challenges	Policies
1. Lack of physical space for entrepreneurs	1.1. Network of coworking spaces/incubators
2. Lack of technology-specialized talent	2.1. Attraction of science and technology universities (PPP models - “Applied Sciences NYC”)
3. Insufficient seed capital available for local startups	3.1. Seed fund supported by the City (“NYC Entrepreneurial Fund” and “NYC Seed”)
4. Limited and uncoordinated community of tech-led innovators and entrepreneurs	4.1. Competitions (“BigApps”) 4.2. Political support for community events and marketing campaigning (in collaboration with Mayor’s office and CDO)

Source: NYCEDC SWOT analysis. (Interview with Dmytro Pokhylko, VP NYCEDC).

Where a pilot project proved successful, it was then scaled up. This is the case of city-sponsored incubators for startup businesses that became cornerstones for the development of the tech industry in NYC. Starting with the first incubator in 2009, NYC currently has 16 city-sponsored incubators scattered throughout the five boroughs, and with specific areas/sectors of focus (see Figure 2.1.)

Network of coworking spaces/incubators

NYCEDC addressed the lack of office space through a pilot project: a coworking space/incubator. This was one of the first policy actions of NYCEDC, with the first city-sponsored incubator (160 Varick Street) opening in 2009. The concept proved successful in addressing the lack of office space and it evolved, expanding its goal to promote entrepreneurship in thematic industries (linked to those identified in previous strategic plans of the city as those where New York has competitive advantage). Today the network of incubators has grown to over 15 across the city and is managed by the Center for Economic Transformation (CET) at NYCEDC²³.

➤ **FIGURE 2.1. Network of NYCEDC-sponsored Incubators**



Source: NYCEDC Website

Incubator	Thematic	Year Launched
1 Varick Street	Thematic	2009
2 CFDA Fashion Incubator	Fashion	2010
3 Chasana Artist Studio	Art	2010
4 BMW Ventures	Media/Tech	2011
5 Dumbo Incubator	Media/Tech	2011
6 Entrepreneur Space	Industrial/Culinary	2011
7 HBK Incubators	Industrial/Culinary	2011
8 Harlem Biospace	BioScience	2013
9 Harlem Garage	General Business	2013
10 Made in NY Media Center	Media/Tech	2013
11 Staten Island Makerspace	Industrial	2013
12 Urban Future Lab	CleanTech	2013
13 Brox Business Bridge	Business	2014
14 BXL Business Incubator	Business	2015
15 TerminalBioBAT Brooklyn Army	BioTech	2016

NYCEDC incubators went beyond traditional incubator models and created communities of entrepreneurs.

NYCEDC introduced elements of coworking spaces as well as community-building activities that went beyond the traditional concept of incubator. The space for startups is normally open plan, making it easier for startups to meet and mingle. The incubator provides traditional business services but goes beyond that, also providing a network of mentors and educational seminars for resident startups (which is more like an accelerator services). In addition, the incubator had to connect with the community and develop events for that purpose, such as educational connection programs with local schools, events linking resident entrepreneurs with local business, events to generate networking (for example, meetups, hackathons, and so on)²⁴, all of which are similar to services provided by tech com-

munity spaces. By adding these services, NYCEDC was able to address the challenge of growing the community of tech startups in parallel to the lack of office space.

NYCEDC developed its network of incubators in partnership with the private sector, attracting investment.

NYCEDC followed a PPP model for its incubators, where NYCEDC provides funding for operational costs for a period of time and provides the space and its renovation at subsidized rates to kickstart the incubator (NYC Committee on Small Businesses 2011). However, it is the private operator who ultimately bears the financial and operational responsibility for the project. The city-sponsored incubator model is a multipartnership one as described in Table 2.3 and Box 2.2.

➤ **TABLE 2.3. City-sponsored Incubator Model**

Operator	Additional partners (e. g., space provider/donors)	NYCEDC
<ul style="list-style-type: none"> ➤ Bears financial and operational responsibility for the project ➤ Collects rent and pays operating expenses ➤ Provides education and training for tenants ➤ Creates a community within the incubator and with other city incubators 	<ul style="list-style-type: none"> ➤ Bears financial and operational responsibility for the project ➤ Provide in-kind services and support, such as furniture, pro bono or discounted professional services, etc. 	<ul style="list-style-type: none"> ➤ Selects and contracts the operator through a public tender ➤ Facilitates relationship between the operator and landlord ➤ Provides financial assistance to fit out the incubator space ➤ Helps raise public awareness

Source: NYCEDC.

BOX 2.2. How the NYCEDC Incubator Partnership Worked in Practice

For the first city-sponsored incubator (Varick Street), opened in July 2009, NYCEDC helped negotiate a three-year master lease between the Polytechnic Institute of New York University (Operator) and Trinity Real State (Space provider), who provided 16,500 square feet of prime real estate. The polytechnic, since renamed the NYU Tandon School of Engineering, was responsible for the operation and management of the incubator, while NYCEDC provided the initial financial assistance required for the fit out and operation of the incubator. In the DUMBO incubator case, for example, which opened in January 2011 and which was also operated by NYU Tandon School of Engineering, the amount disbursed by NYCEDC added up to \$250,000 and was distributed the following way:

- > \$100,000 for the development of the project site to accommodate as many physical workstations as possible;

- > \$50,000 for the launch and lease of the work spaces;
- > \$30,000 for the management and further development of the business incubator;
- > The remaining \$70,000 for the required updates and reports to NYCEDC on the operation of the business incubator.

After the financial support from NYCEDC was totally disbursed, the operator was responsible for the continuation of the incubator operations on its own. Apart from the donors and sponsors that supported the Incubator, Bloomberg LP and Thomson Reuters agreed to provide data feeds at no cost, and university partners provided mentoring services, business seminars, and networking opportunities for tenants.

NYCEDC's network of incubators catalyzed the development private sector-led of incubators, accelerators, and coworking spaces in the city and fostered a community of entrepreneurs.

The city-sponsored incubators served to attract private-sector led incubators and accelerators, which starting appearing in the city widely from 2011 (Table 1.6 Thematic Accelerator Programs in New York). Moreover, they were pioneering in creating a community of startups in areas of the city that would then become clusters (such as the Meatpacking District, Downtown, Flatiron District, and Brooklyn). Prompted by the additional services introduced by NYCEDC beyond traditional incubator models, some of the city-sponsored incubators, such as General Assembly, evolved into complete new businesses and created the bootcamp education category, serving the city's tech rapid skills-training needs (see Table 1.3). The 16 opened and upcoming incubators have collectively raised more than \$125 million in venture funding, comprising more than 160,000 square feet of office space and currently host more than 600 startups employing about 1,000 people (NYCEDC's Blog 2013).

Attraction of Science and Technology Universities

NYCEDC targeted the lack of homegrown tech talent through the attraction of applied science campuses in New York City.

This was one of the most ambitious initiatives of the policy program and attracted the full support of the mayor, which made it a flagship initiative. The program (called Applied Sciences NYC) was launched in 2010²⁵ and aimed to attract at least one major university campus in the applied sciences to New York City. As with the other policies to support the tech ecosystem, Applied Sciences NYC proposed a PPP, incentivizing the attraction of a top university to New York by providing funding and land for the campus (NYC Office of the Mayor 2010). In July 2011 a Call for Proposals was launched and in October of the same year seven qualifying responses were received from 17 institutions from around the globe (out of 27 interested institutions). The result was the establishment of Cornell Tech Campus in the city, which is planned to start by 2017²⁶ (see Box 2.3).

BOX 2.3. Cornell-Technion Innovation Institute on Roosevelt Island

In December 2011 New York City announced the creation of the first Public-Private Partnership between the City of New York and a consortium of institutions led by Cornell University and the Technion to create a graduate engineering school from scratch (Next City 2012) that would be located on Roosevelt Island and would receive \$100 million in capital initial investment from the city to build a \$2 billion and two million square foot campus. On December 19, 2013, the city, Cornell University, and Technion-Israel Institute of Technology signed a 99-year lease for the 12 acres of Roosevelt Island, with construction of

the campus beginning in January 2014. The first full classrooms are expected to open in 2017. Meanwhile, on January 21 2013, the first class of eight students, also known as the beta class (The New York Times 2013), began pursuing a one-year Cornell Master of Engineering degree in computer science at office space donated by Google to Cornell-NYC Tech during campus construction (NYCEDC's Blog 2012). The campus will also have an incubator space, R&D labs, and a \$150 million fund for local startups.

The city complemented the attraction of a university campus with partnerships to develop research centers and strengthening the science departments of existing universities in the city:

New York University and Columbia University. This reinforced the two existing universities, introducing partnerships with the private sector (see Box 2.4).

Prompted by Cornell Tech Campus, both NYU and Columbia strengthened their engineering and science offering. NYU created the NYU Polytechnic School in 2014 after merging with the Polytechnic School (renamed as New York University Tandon School of Engineering in 2015), providing a second full campus for applied sciences in the city.

BOX 2.4. NYU and Columbia Research Center Partnerships

NYU Center for Urban Science and Progress. On April 23, 2012, the City announced a s NYU Center for Urban Science and Progress. On April 23, 2012, the City announced a second partnership agreement within the Applied Science NYC initiative with a consortium of top academic institutions and private technology companies to create the NYU Center for Urban Science and Progress (CUSP), to be located in Downtown Brooklyn. The CUSP consortium is a partnership led by NYU and the Tandon School of Engineering that focuses on research and development in technology to address the critical challenges facing cities: infrastructure, technology integration, energy efficiency, transportation congestion, public safety, and public health. From initial studies, the city expected that the new research and technologies developed at the center could generate about \$5.5 billion in overall economic impact and 7,700 jobs over the next thirty years²⁷.

Institute for Data Sciences and Engineering at Columbia University. In July 2012, the city and Columbia University announced the creation of a new Institute for Data Sciences and Engineering (NYCEDC 2012). As part of the agreement, the city provides \$15 million in critical financial assistance to Columbia – including discounted energy transmission costs and partial debt forgiveness – as well as valuable lease flexibility leading to the development of the institute. The agreement includes the creation of 44,000 square feet of new applied science and engineering space on Columbia's campus by 2016 and the addition of 75 new staff over the next decade and a half. The focus of the new institute will be on advances in the data sciences.

Seed Fund supported by the City

Access to seed funding for local startups was addressed by supporting the creation of a seed funds with the mandate of investing in New York City startups. NYCEDC supported two initiatives to catalyze seed funding to New York grown startups. In both cases, NYCEDC followed a PPP approach, providing support for private partners to collaborate and kick start support for local startups. In 2008, NYCEDC supported the creation of NYC Seed, an

accelerator program for New York startups. This initiative is an evolution of the incubator model, advancing the seed funding needs that are provided by a full accelerator program. NYC Seed provided mentorship, initial seed funding, and an accelerated program to develop products from concepts²⁸ (see Box 2.5). In 2010, the city launched the New York City Entrepreneurial Fund, a comatched fund for seed investing in New York startups. This fund addressed the lack access to VC funding by New York startups.

BOX 2.5. NYC Seed

Announced in 2008, NYC Seed is a public-private partnership initiative that supports seed-stage startups in the city of New York. Additionally, funding and mentoring from notable entrepreneurs and venture capitalists are provided to help businesses move from concept to product, fostering the next

generation of NYC tech companies. NYC Seed is a partnership between the Partnership Fund, ITAC, NYCEDC, Empire State Development and Polytechnic Institute of NYU²⁹. The \$2 million fund invests up to \$200,000 per homegrown web startup (The New York Times 2009).

NYCEDC contribution to New York City Entrepreneurial Fund (NYCEF) was a catalyst and NYCEDC did not intervene in investment decisions. Through a contest, NYCEDC partnered with a professional investor manager, FirstMark Capital, to create NYCEF³⁰. NYCEDC contributed \$3 million out of the \$22 million fund, the remaining being topped by FirstMark Capital, who also provided industry insight, proprietary relationships, and operational expertise. Under the terms of the fund, FirstMark Capital was responsible for sourcing and evaluating potential investments, negotiating terms and conditions, and closing each seed investment; it also monitored the performance of the companies in which the NYCEF's funds that were invested. NYCEDC did not set any rules for investment, except that startups should be located in New York City, pertain to the tech sector, and not be involved in illegal or illicit activities. This provided complete freedom to the fund operator to decide investments based on market criteria, similar to how an independent VC would operate³¹.

NYCEF resulted in attraction of private sector funding for local startups. Following the creation of NYCEF and its investments, local and outside-of-the-city VCs were attracted to invest in New York startups. Today, New York is the second largest tech startup ecosystem in the United States in terms of VC funding for local startups (see Section 1: The Growth of the Tech Startup Ecosystem in New York).

Community-Building Policies

Community building was addressed through multiple interweaved policies involving both NYCEDC and the mayor's office, which included: (a) apps competitions, (b) active support from the mayor's office, and, (c) a promotion campaign and attraction of tech multinationals and startups.

Competitions began as a tool of open government and resulted in an effective community-building tool. Initially, when launched in 2009, the city apps competition (BigApps Competition³²) was designed to make use of the recent open data made available by the city. The idea was to offer monetary prizes following a hackathon format for the tech community to develop useful apps using the data provided by the city. The competition was part of the Open Government strategic line of the Digital Road Map and was part of a group of initiatives, including the city's apps hub, its developers' portal, and the release of data³³. By 2014, and as the Open Government goal was achieved, NYCEDC shifted the BigApps competition to focus on its community-building impact, fostering the connection aspects. The BigApps competition was transformed into a tech community event where participants collaborate and solutions focus on the city's problems for the benefit of the community³⁴. In its fifth edition in 2014, 20 finalists competed for more than \$100,000 in cash prizes. The competition also links with the incubator net-

work and the city fund of the city and many projects are then hosted in the network of incubators (provided they qualify), connecting both networks of entrepreneurs and mentors. For instance, the first investment of NYCEF was a winner of the BigApps competition in 2010³⁵.

The mayor's office provided active support to the tech community, participating in events and meetups, and creating a point of contact for the community in the city: the Chief Digital officer (CDO). The mayor and the CDO have participated personally in the tech community's events since 2008. The Mayor could be seen with early entrepreneurs in the First Internet Week Event in New York in 2008 or in New York Tech Meetups supporting the community and promoting New York as a city for entrepreneurs. The appointment of a CDO in the city to interact with and support the tech community provided additional backing combined with agile reaction to the community's needs.

The city launched an intense promotion campaign to highlight New York's entrepreneurs to attract talent and raise the profile and significance of the tech community. The city launched "We are Made in NY" in 2002, an economic development initiative that focuses on the local tech sector, highlights job opportunities, attracts new companies to the city, and presents a host of education programs that support learning at every literacy level. Expanding the Made in NY Mark of Distinction for digital companies that base at least 75 percent of their development in NYC, to capitalize on local talent and achievements, was also another focal point to promote the city's tech sector. The city also created a central point of information for the tech ecosystem in New York, Digital.NYC, where interested parties could access information about startups, investment, spaces, or training courses in the city. All this was combined with advertising and promotion of success stories of entrepreneurs, raising the profile of New York as a tech startup hub. In parallel, the mayor's office also involved itself in attracting prominent tech startup to open operational offices in New York, offering tax breaks.

Additional Supportive Policies

New York combined NYCEDC operational policy actions with strategic support actions. As part of the strategic policies stemming from the NYC Digital City Roadmap, the city supported the tech startup ecosystem through: (a) development of broadband access infrastructure, and (b) government as a platform as part of the open government agenda. On connectivity, by 2013, 99 percent of New Yorkers had residential access to high-speed broadband,

over 50 parks had free public Wi-Fi, 300,000 low-income residents were able to access the internet, and 36 NYC underground subway stations had Wi-Fi access. On government as a platform, the city opened its data, provided APIs, made a hub for developers, and showcased apps based on city data. This was combined with a yearly competition (BigApps competition, see above) which connected with the other community building and funding initiatives of the city.

3.

LESSONS FROM NEW YORK CITY'S CASE

The New York City case highlights interesting lessons for policy action to support the growth and sustainability of a tech startup ecosystem. These lessons can inform policies in other cities.

< 1 > Action plan was tailored to New York's challenges, which were identified together with the ecosystem stakeholders. NYCEDC's starting point was to analyze the city's tech ecosystem and understand its key challenges. Every city is different and the challenges it may face are not the same as in other cities. Ecosystems, although having similarities, are also unique and have different challenges and opportunities. By focusing on its local challenges, the city could focus on targeted policies with direct results that build upon each other. More importantly, NYCEDC did not identify the challenges alone. Rather, it worked with the ecosystem, through an intense consultative process and bottom-up approach, which ensured that the challenges identified were validated by the stakeholders, being the "real" challenges of the ecosystem (see <3> below).

< 2 > There was clear leadership support from the mayor and continuing city endorsement. The personal endorsement from the mayor changed perceptions of New York as a city for tech entrepreneurs. The backing of the mayor in tech events and showcasing New York startups reinforced the community and provided a socially respectable image of tech entrepreneurs in the city. In building communities, social perception matters which can set growth dynamics and develop champions outside the city to push for that growth (for example, the private sector, civil society, academia, and so on). This change in perception was critical in making the community believe in itself and enabling it to attract tech entrepreneurs to New York. The city combined this high-level political backing with the creation of a single point of contact for the city with tech entrepreneurs (the CDO) and a policy of open government to catalyze tech startup growth (see <12> below).

< 3 > The city built a coalition of partners involving the whole ecosystem. New York City did not work alone. Instead, the mayor's office, NYCEDC, and the other city institutions developed a coalition of partners to support the growth of the tech startup ecosystem. This involved universities, the private sector, entrepreneurs, civil society, and oth-

er interested parties. There was a clear policy from the outset to involve as many partners as possible and attract them to the goal of growing the tech community in New York City. NYCEDC developed its policies in close contact with the ecosystem's stakeholders, through focus groups and meetings, and ensured that each policy had the buy-in and backing of the ecosystem's stakeholders. These meetings resulted in a coalition of partners. The mayor's office attracted institutional stakeholders, including large universities and multinational tech companies, as well as empowered the community. This was critical in obtaining the buy-in of the ecosystem itself and ensuring sustainability, while the city focused its resources on catalyzing the growth of the ecosystem strategically.

< 4 > Combination of operational and strategic vision approaches. New York's approach was pragmatic, addressing specific challenges through actions that provided quick wins in combination with a clear strategic vision (through Digital City Roadmap). This combination provided guidance for the policy actions, but allowed flexibility for NYCEDC to respond to changes in the environment, respond rapidly to new challenges, and modify its initiatives when needed. It also allowed for quick results (while the umbrella strategic plan was being developed) that encouraged the community of entrepreneurs and reinforced the idea that city support for the ecosystem was not just a paper plan.

< 5 > Policies were only applied where there was a market failure. The city was careful to only develop policies where there was a market failure. The SWOT analysis and thorough involvement of the ecosystem identified the challenges that were not being addressed. The city intervention was also limited in time with the goal of catalyzing the stakeholders themselves to address the challenges. These criteria ensured that the city's intervention did not result in market distortions that would alter the ecosystem and that resources were used in the most targeted way.

< 6 > City intervention was limited to catalyze market solutions, providing sustainability and making the most effective use of public resources. NYCEDC's interventions aimed at catalyzing the private sector and other stakeholder involve-

ment. NYCEDC's typical method of working was to launch public tenders to attract private operators to manage the initiative and to actively contribute resources, which reinforced the idea of partnership and increased the commitment of the city's partners. Examples of this include the incubator network and the seed fund initiatives. In the first one, the city provided the initial funding for operation costs and the refurbishing of the office space, and mediated with third parties to obtain below-the-market or donated real estate space. In the second case, the city provided a small percentage (Dmytro Pokhylyk, VP NYCEDC) of the fund, the rest being leveraged from the private sector. The management of both initiatives was reserved for the private sector partners, with no involvement of NYCEDC in daily operations. This approach proved successful in providing sustainability to the initiatives that were taken over by the "partner." At the same time, it liberated resources for the city to apply to other initiatives.

< 7 > A pilot/scale up approach allowed for flexibility and rapid testing of policy actions. Using pilots allowed NYCEDC to test policy approaches and assess their potential impact before fully committing resources. There were no existing policies designed or tested for the challenges New York City was addressing and NYCEDC had to try new approaches. Pilot testing allowed for experimentation and new approaches that could be tested rapidly and adapted or discarded for better results. The city applied a similar approach to the lean startup model, in which iteration allows for pivoting and adapting the policies to achieve better results before scaling up. The fact that the city could use an agile organization like NYCEDC to do that allowed for such an approach.

< 8 > Policies addressed the tech startup ecosystem as a "community," strengthening its social dimension. Intuitively or purposely, New York City approached the ecosystem as a community that had to be nurtured and grown. Example of this include the emphasis on social events in the incubator network or the policies to grow the community directly. By taking this approach, New York City created a social environment that grew stronger with each new policy action. New York's policies were different to other city's policies to promote innovation or startup ecosystems, which typically considered the ecosystem as a set of different players or layers, each of one of which was the target of the policies. The policies that New York developed addressed the social connection among the different stakeholders, empowering its members to grow and take ownership of the ecosystem. Research by World Bank (Mulas, V., Mingos, M. and Applebaum, H. 2015) and Endeavor Insight (2014) shows that the social di-

mension was the key for the growth and sustainability of the ecosystem.

< 9 > Policies had no geographic boundaries in the city and they were not limited to a unique "tech district". New York did not focus on a specific geographic area. Instead it aimed at developing the ecosystem across the city. Even policies where it had to choose geographic locations, such as the incubator network, evolved to spread throughout the city and support the growth of the tech startup community in new neighborhoods (for example, Brooklyn or Queens). This approach ensured that the benefits of the tech startup ecosystem spread throughout the city and allowed the ecosystem to grow and flow organically (in fact, the ecosystem moved and expanded naturally throughout the city as neighborhoods, supportive infrastructure, and rents changed (see Section 1: The Growth of the Tech Startup Ecosystem in New York). This approach is consistent with understanding the ecosystem as a community and it contrast with other policies that target "innovation districts," limiting the policy scope to a single neighborhood.

< 10 > The skills pipeline was addressed early on with multiple combined approaches. The city addressed the need for a larger pipeline of talent through multiple approaches. For the long term, the city attracted new engineering and applied science campuses to the city. This was combined with a myriad of short-term policies imbedded within city's program. For instance, in the incubator network the city required the partners to provide tech skills educational courses. This resulted in short-term skills for the tech community, and in new models of rapid tech skills training (the "bootcamps") with General Assembly (one of the incubators of the network) evolving into one of the largest bootcamp providers in the world. There were many other actions, such as providing tech skills in public libraries and supporting the introduction of coding in public schools. Some of these approaches proved more successful than others, but the mix of all of them served to highlight the importance of tech skills for education in the city and attract new talent into building these skills for the future.

< 11 > Strong emphasis on behavioral and perception change with use of promotion and marketing campaigns. In parallel to the operational policies, the city developed a promotion and marketing campaign to change social perception of tech entrepreneurs and change the image of New York into a welcoming city for tech entrepreneurs. This was coupled with targeted support by the mayor and the city through the CDO for the tech startup community, raising its relevance. This was crucial in changing the social dy-

namics enabling growth of the ecosystem and the support of a community of stakeholders beyond the tech entrepreneurs themselves, bringing in large corporations, universities, and civil society from around the city. It also increased the image of the city to attract talent for the tech ecosystem, which previously did not consider New York as a tech-friendly city. This was especially relevant for New York, given that over 80 percent of the tech founders came from outside the city (Endeavor Insights 2014).

< 12 > The city government served as an active platform for the development of tech solutions.

The support of the city went beyond promotion and formal backing. The city consciously developed a policy of open data and open government, which fed the tech startup community. There was a strategy to provide open data, with tools specific to open data from the city, combined with an invitation to tech entrepreneurs to address challenges (for example, the BigApps Competition). These policies were connected with the network of incubators or the seed fund to grow the ecosystem and form a larger community. The provision of the city's data and challenges served as a catalyst to form cohorts of potential startup founders through hackathons and competitions which connected socially to feed the tech community.

The research for this report included the following interviews and places visited in New York City during the week of [May 18-22], 2015. Additional interviews were conducted in previously via phone.

Institution	Category	Name	Title
General Assembly ^a	Community Space / bootcamp provider / Successful startup	Mandy Le	Head of Market Expansion
Endeavor Insight ^a	Research / Entrepreneurship support	Rhett Morris, Matt Lerner	Director of Endeavor Insight, Associate
Urban Future Lab/NYC Accelerator for a Clean Renewable Economy (ACRE) ^a	Incubator / Accelerator	Joe Silver	Project Manager
LittleBits ^a	Successful startup	Alisson Vannatta	Account Manager
New York University (NYU) Office of Industrial Liaison (OIL) ^a	University	Abram Goldfinger	Executive Director
Google (New York Office) ^a	Tech Company	William Floyd	Head of External Affairs
NYCEDC ^a	City Government / Ecosystem Catalyzer	Dmytro Pokhylko	VP NYCEDC
NYC Major's Office, Office of Technology and Innovation ^a	City Government	Dave Selinger	Project Manager
WeWork ^a	Successful startup / coworking space provider	Matt Shampine	VP of Business Development
The Center for an Urban Future ^a	Think Tank / Research	Jonathan Bowles	Executive Director
Bloomberg Philanthropies / Associates ^a	Think Tank / Research	Todd Asher, Shaina Horowitz	Media and Technology Strategies Team
Gust / Digital NYC ^a	Angel investor / Research	David Rose	CEO, Gust
Office of Intellectual Property and Tech Transfer Columbia University / Columbia Tech Ventures ^a	University	Orin Herskowitz	VP / Executive Director

Institution	Category	Name	Title
DUMBO Incubator ^a	Incubator / Accelerator	Craig Wilson	Manager
Manhattan Borough President's Office	City government / Borough	Will Colegrove	Director Budget and Transparency
State of New York	State government	Rachel Haot	Chief Digital officer and Deputy Secretary for Technology
Office Council Member James Vacca – Chair Committee of Technology	City Government / Councilmember	Stacey Gardener	Legislative Director
iZone / NYC Department of Education	City Government	Kara Chesal	Program Manager
Office Council Member Laurie Cumbo – Chair Committee of Women's Issues	City Government / Councilmember	Monica Abend	Deputy Chief of Staff
Krash	Coworking space	Mykim Dang	Director of Marketing
Uncubed	Community space / Tech skills provider	Tarek Pertew	Co-Founder and COO
Shutterstock	Startup	Niamh Hughes	Tech Communications Manager
Coalition for Queens	Coworking space / bootcamp provider	Jukay Jsu, Marina Tran	Founder, Director of Community and Partnerships
Techstars NYC	Accelerator	KJ Singh	Director
NYC Tech Meetup	Meetups / Community catalyzer	Jessica Lawrence	Executive Director
Meetup.com	Meetups / Community catalyzer	Kristin Hodgson	Communications Director
Beta NYC	Startup	Noel Hidalgo	Co-founder
Enstitute	Startup	Kane Serhan	Founder
Audience.io	Startup	Courtney Boyd Meyers	Founder

Note: a Visited onsite.

APPENDIX B. LIST OF DETAILED SOURCES FOR TABLES & FIGURES

(TABLE 1.1) Tech Startup IPOs since 2008

Company	Reference
Etsy	<p>Xconomy. 2015. Why Etsy's IPO Could Silence Haters of the New York Tech Scene. April. http://www.xconomy.com/new-york/2015/04/20/why-etsys-ipo-could-silence-haters-of-the-new-york-tech-scene/</p> <p>The Verge. Etsy completes its IPO, valuing the craft marketplace at over \$3.5 billion. 2015. April. www.theverge.com/2015/4/16/8428627/etsy-ipo-goes-public</p>
OnDeck	<p>Xconomy. 2014. That OnDeck \$200M IPO, and Keeping Things Real in the New York Scene. December. www.xconomy.com/new-york/2014/12/24/that-ondeck-ipo-and-how-to-keep-things-real-in-the-new-york-scene/</p> <p>NY Times. 2014. OnDeck, a Lender to Small Businesses, Raises \$200 Million in I.P.O. http://dealbook.nytimes.com/2014/12/16/ondeck-a-lender-to-small-businesses-raises-200-million-in-i-p-o/?_r=0</p>
Everyday Health	<p>Seeking Alpha. 2014. Everday Health IPO Less Vigorous than it sounds. March. http://seekingalpha.com/article/2114393-everyday-health-ipo-less-vigorous-than-it-sounds</p> <p>Recode. 2014. Every day health raises 100 million in IPO but Shares Dip in Early Trading. March. http://recode.net/2014/03/28/everyday-health-raises-100-million-in-ipo-but-shares-dip-in-early-trading/</p> <p>Fortune. 2014. IPO watch: Everyday Health. March. http://fortune.com/2014/03/28/ipo-watch-everyday-health/</p>
Borderfree	<p>Reuters. 2014. Boderfree prices IPO at top end of \$14-\$16 range: underwriter. March. http://www.reuters.com/article/2014/03/20/us-border-free-ipo-idUSBREA2J2D020140320</p>
Varonis Systems	<p>Yahoo. 2014. Varonis Systems. February. http://finance.yahoo.com/news/varonis-systems-friday-hot-ipo-161010681.html</p> <p>Reuters. 2014. Data Security firm Varonis Systmes raises IPO to \$22/share. February. http://www.reuters.com/article/2014/02/28/varonissystems-ipo-idUSL3NOLW4ZR20140228</p>
Tremor Video	<p>Crunchbase. 2013. Tremor Video. June. https://www.crunchbase.com/ipo/da03beda0798fced34b1c37de5399aff</p> <p>CBS insights. 2014. OnDeck Capital is New York's Largest Backed Tech Exit Ever. December. https://www.cbinsights.com/blog/ondeck-capital-largest-new-york-vc-backed-tech-exit/</p>
Shutterstock	<p>Bloomberg. 2012. Shutterstock surges after IPO Priced above range. October. http://www.bloomberg.com/news/articles/2012-10-11/shutterstock-surges-after-ipo-priced-above-range-at-17</p>

(FIGURE 1.3) New York Tech Meet up Members per Year

NYTech Meetup. https://nytm.org/members
Attending. Lessons from the largest Meetup Group in the World. http://writing.attending.io/pieces/lessons-from-the-largest-meetup-group-in-the-world
TechCo. 2015. Jessica Lawrence Video Interviews. March. http://tech.co/jessica-lawrence-video-interview-sxsw-2015-03
Venture Beat. 2013. New York Tech Meetup steps up to help shape NYCS Tech Policy. January. http://venturebeat.com/2013/01/24/new-york-tech-meetup-steps-up-to-help-shape-nycs-tech-policy/
New York Angels. http://www.newyorkangels.com/about.html

(TABLA 1.4) New York Tech Meet up Members per Year

Company	Reference
Google	Village Voice, 2006. Google: The New Port Authority. September. http://www.villagevoice.com/news/google-the-new-port-authority-6418743
	City Room. 2008. Google Expands its New York Footprint. June. http://city-room.blogs.nytimes.com/2008/06/23/google-expands-its-new-york-footprint/
	Urban Land. 2014. Making Space for More Tech Firms in New York City. August. http://urbanland.uli.org/economy-markets-trends/making-space-tech-firms-new-york-city/?utm_source=feedly&utm_reader=feedly&utm_medium=rss&utm_campaign=making-space-tech-firms-new-york-city
	Vault.2014. Google Wants 600,000 More Square Feet of NYC Office Space. April. http://www.vault.com/blog/job-search/google-wants-600000-more-square-feet-of-gotham-city-office-space/
	Fortune. Its been 10 years Google is Officially a New Yorker. May. http://fortune.com/2013/05/22/its-been-10-years-google-is-officially-a-new-yorker/
	The Ladders. Google Doubles Down on New York IT Jobs. http://info.theladders.com/blog/bid/150994/Google-Doubles-Down-on-New-York-IT-Jobs
Data Center Knowledge. 2005. Huge leases for googlenet at 111 Eighth Ave. http://www.datacenterknowledge.com/archives/2005/09/23/huge-lease-for-googlenet-at-111-eighth-ave/	

Company	Reference
Facebook	<p>Bloomberg. 2011. Facebook to open New York Engineering Office as Website prepares for IPO. December. http://www.bloomberg.com/news/articles/2011-12-02/facebook-to-open-new-york-engineering-office-as-website-prepares-for-ipo</p> <p>Quartz. 2014. How Facebook's fancy New York office explains its management philosophy. July. http://qz.com/229542/facebook-office/</p> <p>Zdnet. 2011. Facebook announced that it will open a major engineering office in New York city in early 2012. December. http://www.zdnet.com/article/facebook-announces-open-engineering-office-in-new-york-city/</p> <p>IBTimes. 2011. Inside Facebook's New York Office at 335 Madison. December. http://www.ibtimes.com/inside-facebooks-new-york-office-335-madison-photos-378072</p>
Ebay	<p>Gigaom. 2012. Ebay puts down roots in NYC with data-focused tech center. May. https://gigaom.com/2012/05/03/ebay-puts-down-roots-in-nyc-with-data-focused-tech-center/</p> <p>Crains New York. 2013. How eBay NY plans to conquer the world. May. http://www.crainsnewyork.com/article/20130512/TECHNOLOGY/305129973/how-ebay-ny-plans-to-conquer-the-world</p> <p>Crain's. 2015. PayPal gets its own office in the West Village. May. http://www.crainsnewyork.com/article/20150513/BLOGS03/150519949/paypal-gets-its-own-office-in-the-west-village</p>
Microsoft	<p>Microsoft Research Blog. http://research.microsoft.com/en-us/news/features/msrnyc-050212.aspx</p> <p>Bloomberg. 2013. Microsoft Leases Manhattan Offices in 11 Times Square. January. http://www.bloomberg.com/news/articles/2013-01-07/microsoft-leases-manhattan-offices-in-11-times-square</p> <p>Microsoft. 2013. New York City Lab Lands in Silicon Alley. April. http://blogs.technet.com/b/inside_microsoft_research/archive/2013/08/19/new-york-city-lab-lands-in-silicon-alley.aspx</p> <p>The Free Library. Microsoft leases 100,00 SF of space. http://www.thefreelibrary.com/Microsoft+leases+100,000+SF+of+space.-a0100243448</p> <p>PC. 2012. Microsoft Opens New York Research Lab with Former Yahoo Scientists. May. http://www.pcmag.com/article2/0,2817,2403915,00.asp</p>

Company	Reference
Yahoo	<p>Tech Crunch. 2013. Yahoo Sets up Shop in Times Square for its 500 New York Employees. May. http://techcrunch.com/2013/05/20/yahoo-sets-up-shop-in-times-square-for-its-500-new-york-employees/</p> <p>Bloomberg. 2013. Yahoo will expand in New York City with New Times Square Office. May. http://www.bloomberg.com/news/articles/2013-05-20/yahoo-will-expand-in-new-york-city-with-new-times-square-office</p> <p>New York Times. 2013. Yahoo to consolidate New York Headquarters in Times Square. May. http://www.nytimes.com/2013/05/21/nyregion/yahoo-to-consolidate-new-york-headquarters-in-times-square.html</p> <p>PC. 2012. Microsoft Opens New York Research Lab with Former Yahoo Scientists. May. http://www.pcmag.com/article2/0,2817,2403915,00.asp</p> <p>Rew. 2011. Yahoo leases 50000 SF at 1540 Broadway. http://rew-online.com/2011/04/01/yahoo-leases-50000-sf-at-1540-broadway/</p>
LinkedIn	<p>Business Insider. 2013. LinkedIn Finished Renovating Its Empire State Building Offices and Gave us a Tour. April. http://www.businessinsider.com/linkedin-office-tour-2013-4</p> <p>The Real Deal. 2014. LinkedIn Expands out at Empire State Building. March. http://therealdeal.com/blog/2014/03/04/linkedin-expands-out-at-empire-state-building/</p>
Yelp	<p>Crains New York. Real Estate Deal Watch. http://www.crainsnewyork.com/data-lists/real-estate-deal-watch/details/12/2959697</p> <p>Daily News. 2011. Yelp Unveils NYC office space in Union Square. October. http://www.nydailynews.com/new-york/yelp-unveils-nyc-office-space-article-1.968465</p>

(TABLE 1.6) Thematic Accelerator Programs in New York

Company	Reference
Barclays	Bitcoin. 2015. Barclays Launches Fintech Innovation Hub Rise New York, Other Rise Hubs to Follow. July. https://bitcoinmagazine.com/21257/barclays-launches-fintech-innovation-hub-rise-new-york-rise-hubs-follow/
FinTech Innovation Lab	Crunchbase. Fintech Innovation Lab London. https://www.crunchbase.com/organization/fintech-innovation-lab-london
Value Street Lab	Crain's. 2014. The New Wall Street. August. http://www.crainsnewyork.com/article/20140902/TECHNOLOGY/308319990/the-new-wall-street
New York Digital Health Accelerator	Partnership for New York City. 2014. The Partnership Fund's 'NY Digital Health Accelerator Announces Programs 2014 Class of Entrepreneurs. July. http://pfny.org/news_press/new-york-digital-health-accelerator-announces-top-pick-companies-for-2014/

Company	Reference
Blueprint Health	https://www.blueprinthealth.org
Startup Health	Crunchbase. Startup Health. https://www.crunchbase.com/organization/startup-health
EDGE EdTech	http://www.edgeedtech.com/ PR Newswire. 2015. Edge Edtech. Launches Accelerator in New York City for Education Technology starts ups offering 170000 in funding to ten selected companies. https://www.crunchbase.com/organization/startup-health
Kaplan EdTech	Crain's/ 2014. Tech accelerator's grab for equity. March. https://www.crunchbase.com/organization/startup-health http://kaplanedtechaccelerator.com/
Meta Prop NYC	Crain's/ 2014. Tech accelerator's grab for equity. March. https://www.crunchbase.com/organization/startup-health http://kaplanedtechaccelerator.com/
Crunchbase. Metaprop NYC.	https://www.crunchbase.com/organization/metaprop-nyc
New York Tech Fashion Lab	http://www.nyftlab.com/

(TABLE 1.7) Examples of New York Tech Startups Generating New Market Categories

Starups	Website
Etsy	etsy.com
Gilt Groupe	gilt.com
Kickstarter	kickstarter.com
Makerbot	makerbot.com
Quirky	quirky.com
Foursquare	foursquare.com
WeWork	wework.com
General Assembly	generalassemb.ly

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name=http%3A%2F%2Fwww.nyc.gov%2Fhtml%2Fom%2Fhtml%2F2009b%2Fpr335-09.html&c-c=unused1978&rc=1194&ndi=1.

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NYC Office of the Mayor. 2011. "Mayor Bloomberg and Chief Digital Officer Rachel Sterne Unveil 'Road Map For The Digital City' - A Plan To Make New York The Nation's Leading Digital City." Press Releases, May 16. <http://www1.nyc.gov/office-of-the-mayor/news/158-11/mayor-bloomberg-chief-digital-officer-rachel-sterne-em-road-map-the-digital#/2>.

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NOTES

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- ² Angelist, <https://angel.co/>.
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- ⁶ Bootcamps.in, <http://www.bootcamps.in/>.
- ⁷ NYU Polytechnic School of Engineering, <http://engineering.nyu.edu/about/merger>.
- ⁸ Cornell Tech, <http://tech.cornell.edu/>.
- ⁹ See: <http://engineering.nyu.edu/admissions> and <http://engineering.columbia.edu/>.
- ¹⁰ Tech multinationals starting establishing offices since 2006 through acquisitions or by setting small commercial offices. However, it was not until 2010, that tech multinationals started establishing operational corporate offices with core design and engineering functions (see Table 1.4)
- ¹¹ CB Insights, <https://www.cbinsights.com/blog/new-york-tech-investment-report/>.
- ¹² Observer, <http://observer.com/2011/02/the-xoogler-infiltration/>.
- ¹³ Unless noted otherwise, the source of the information for this box is from Etsy's 2015 Form S-1 Registration Statement and 2013 Values and Impact Annual Report.
- ¹⁴ Savills-Studley, <http://www.savills-studley.com/63069c1c-06dd-4fd8-8ad1-7f972007a04e/our-firm-press-room-detail.htm>.
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- ¹⁷ The Wall Street Journal, <http://www.wsj.com/articles/SB10001424052748704247904575240583258102378>.
- ¹⁸ Refers to Zip code 11201. Source: U.S. Census Bureau American Fact Finder.
- ¹⁹ See: <http://www.digitaldumbo.com>.
- ²⁰ See: <http://theleanstartup.com/principles>.
- ²¹ Interview with Rachedl Hort, Chief Digital Officer and Deputy Secretary for Technology, State Government
- ²² Interview with Dmytro Pokhylko, VP NYCEDC.
- ²³ The CET's goal is "to develop the City's major business sectors by implementing policy and programmatic initiatives that address current issues faced by each industry, create good jobs, and promote entrepreneurship and economic diversification across the five boroughs." See: <https://www.nycedc.com/division/center-economic-transformation-0>.
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- ²⁵ NYCEDC: <https://www.nycedc.com/project/applied-sciences-nyc>.
- ²⁶ Cornell: <http://tech.cornell.edu/future-campus>.
- ²⁷ CUSP: <http://cusp.nyu.edu/about-how/>.
- ²⁸ NYC Seed: <http://www.nycseed.com/advisoryBoard.html>.
- ²⁹ Partnership for New York City: <http://pfnyc.org/our-investments/>.
- ³⁰ New York City entrepreneurial Fund: <https://www.nycedc.com/program/nyc-entrepreneurial-fund>.
- ³¹ Interview with Dmytro Pokhylko, VP NYCEDC.
- ³² NYC BigApps: <http://nycbigapps.com/>.
- ³³ See: <http://www.nyc.gov/html/media/media/PDF/90dayreport.pdf>.
- ³⁴ <https://medium.com/@internetweek/q-a-why-bigapps-pushed-past-the-hackathon-a3d4f442f3f6>.
- ³⁵ MyCityWay, <http://www.mycityway.com/>.
- ³⁶ See, for instance: <http://www1.nyc.gov/office-of-the-mayor/news/204-08/mayor-bloomberg-launches-first-ever-internet-week-new-york>.
- ³⁷ Digital.NYC, <http://www.digital.nyc/>.



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