Making University City a World Class Innovation Center

BACKGROUND ANALYSIS AND KEY PRIORITIES

Prepared for

By the Economy League of Greater Philadelphia

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Executive Summary

University City has been home to an impressive amount of important research discoveries, including the first computer and vaccines for whooping cough, mumps, rubella, and rotavirus. Recently, ground-breaking research institutes in nanotechnology, media arts, and the convergence of technology and creative expression have launched, and annual institutional research and development spending totals more than $1.2 billion. While this strong research foundation is a remarkable asset, opportunities exist to increase the rate of technology commercialization in University City and the surrounding Greater Philadelphia region to match or exceed those of other leading research institutions and regions.

With this opportunity to develop a thriving ecosystem of startups and established companies in mind, the University City Science Center, University City District, and Wexford Science + Technology formed the University City Innovation Collaborative (UCIC). In 2010, UCIC hired the Economy League of Greater Philadelphia to complete an analysis of University City’s current innovation environment, examine leading urban innovation centers in other regions, and work with them to develop a set of recommendations for expanding the innovation-based economy in University City and the region.

Based on a review of the significant body of research that looks at how innovation economies develop and flourish, interviews with regional and subject-matter experts, and analysis of other regions, five key elements emerged as critical to a thriving urban innovation center. These include strong research institutions with institutional infrastructure and culture that supports commercialization of research; clustered office and lab space that meets the needs of startups and established companies; a critical mass of entrepreneurs and capital; an entrepreneurial culture that supports risk-taking; and collaborative leadership that invests time and resources in innovation-supporting activities.

Analysis of University City based on these five elements revealed a set of contrasting realities. There is a set of extraordinary assets and capabilities as well as very clear challenges to address in developing an innovation center strategy for University City.

- While University City is a significant research engine, too little commercialization results from this research, as exemplified by the relatively low number of viable startup companies.
- University City has improving amenities and a sense of place, but there is limited opportunity for the private office and lab development that is needed to foster innovation-based economic growth.
- University City has considerable strength in life sciences, but no other major industry sectors that result in a steady stream of licensing and startups.
- University City has an impressive history of research discovery and innovation, but these accomplishments are underappreciated and under-marketed.

With these findings in mind, UCIC set five broad priorities and identified specific short- and long-term strategies for achieving those priorities. To drive this work, UCIC will form an advisory council that includes senior leadership from major University City and regional research and healthcare institutions, as well as industry and venture capital leaders. For these efforts to be successful, other University City stakeholders, including anchor institutions, government, and community organizations, must be actively...
engaged. In addition, the Collaborative members have committed to establishing new shared staff resources that will coordinate the implementation of UCIC strategies.

**Priority 1: Support a climate of innovation in University City and the Greater Philadelphia region**

In the near-term, UCIC will establish a knowledge base and network for research underway at participating regional universities, institutions, and businesses. Rather than duplicating the work of individual institutional efforts, this resource network will be a repository of information about available technologies and relevant research throughout University City and the region for access by researchers, entrepreneurs, and industry.

Longer-term strategies include growing early-stage and proof-of-concept funding in the region, attracting established firms to locate in University City, establishing a venture capital firm presence in the area, and improving coordination across regional technology-based economic development organizations.

**Priority 2: Promote growth of key innovation clusters in University City**

The Collaborative will work to support and grow the existing life sciences strengths in University City in order to increase the commercialization of life sciences research. The Collaborative also will assist institutions in identifying additional cluster opportunities. As new collaborations and cluster opportunities emerge, UCIC will support the creation of additional formalized collaborative research partnerships and institutes to encourage the development of new clusters in areas such as communications, IT, healthcare IT, energy, and new media.

**Priority 3: Plan for and develop office and lab space for innovation-based firms**

The UCIC Advisory Council will convene institutions to discuss planning for business development centers within University City. In coordination with the Philadelphia City Planning Commission, UCIC will work with anchor institutions to identify opportunities to create additional commercial office and lab space suited for startups and established companies. Over the long term, the Science Center will more closely align the tenant mix in its properties with its mission of tech-based economic development, making more room for private enterprise.

**Priority 4: Strengthen quality of place and amenities in key business development areas**

To improve the value proposition for companies and entrepreneurs, UCIC and its partners will continue to improve the physical environment along Market Street, with the longer-term goal of developing ground-floor commercial space on the street and residential facilities to create a more vibrant and dynamic area.

**Priority 5: Market University City’s strengths as an innovation hub**

To raise the profile of University City’s underappreciated assets and track record of success, UCIC will compile innovation success stories across University City institutions, developing a narrative of past and present innovations. UCIC also will develop specific innovation brands for University City and the Market Street corridor.
Introduction

University City has significant assets that have laid the foundation for a thriving innovation economy. However, gaps and weaknesses in the innovation ecosystem have prevented the area from evolving into a fully-developed cluster of innovation-based economic activity and realizing all of the positive benefits associated with such a cluster. Home to world-class research institutions and universities such as The Children’s Hospital of Philadelphia (CHOP), Drexel University, and the University of Pennsylvania, more than $1 billion annually is spent on research by area institutions. Virtually all of these research assets are concentrated in one square mile, creating a remarkable density that is unique to the region and is of the type that has spawned booming innovation economies in other places. Stakeholders like the Science Center are working to capitalize on the opportunity afforded by these assets and have amassed an impressive track record of success. A 2009 economic impact study found that Science Center graduate companies are responsible for more than 15,000 direct jobs in the region, and the 2010 acquisition of University City-based (and Science Center-incubated) Avid Radiopharmaceuticals by Eli Lilly and Company for up to $800 million illustrates the potential value of these companies.

These accomplishments notwithstanding, there is room for considerable growth. University City’s research institutions are not spinning out viable startups or making licensing deals at the rate of top competitors such as Cambridge, MA, and Mission Bay in San Francisco, CA. When startups are formed, they too rarely locate and remain in University City, and established companies are not drawn to locate in the area.

With this in mind, the Science Center, University City District, and Wexford Science + Technology formed the University City Innovation Collaborative (UCIC) and embarked upon a project to create an actionable strategy to make University City a world-class center of innovation.

To lay the foundation for crafting recommendations for University City, this document begins with a thorough background analysis designed to answer two key questions: What assets or characteristics are key to a thriving innovation economy and where does University City stand? To answer these questions, the Economy League of Greater Philadelphia and UCIC partners reviewed the significant body of literature exploring the components of innovation economies, consulted with experts, and visited three diverse established or developing urban innovation centers – Mission Bay in San Francisco, Cambridge, MA, and Cleveland, OH. Based on these findings and stakeholder discussions, the University City Innovation Collaborative has identified five priorities and specific strategies to achieve those priorities.
Part 1: Critical Innovation Center Elements

Leading think tanks like the Brookings Institution and the Milken Institute, government agencies such as the US Economic Development Administration, university researchers, and scores of state and regional organizations have developed an extensive body of literature around innovation economies and clusters in which they identify metrics that can be used to evaluate the performance of innovation ecosystems and provide recommendations for strengthening them.

Informed by numerous reports and extensive interviews with experts, the Economy League has identified five main elements critical to a successful innovation center: strong research institutions; clustered office and laboratory space; a critical mass of entrepreneurs and capital; entrepreneurial culture; and collaborative leadership. While these do not encompass every component present in thriving innovation clusters, they broadly represent the most important factors and provide a framework for considering University City’s strengths and gaps as well as shaping case study findings.

**Strong Research Institutions**

Well-funded academic and research institutions are the bedrock of an innovation economy. Research conducted at these institutions can lead to discoveries, inventions and techniques that can be commercialized as products and services by new companies or through licensing deals with existing companies. While research funding lays the foundation for innovation, it by no means guarantees it, as the type of research being executed may or may not lend itself to commercialization. In addition, almost as important as the type of research are institutional operations and culture, which determine whether there are incentives and mechanisms for the research being performed to be quickly and easily translated to the marketplace.

Institutions that exhibit high rates of technology transfer share several important characteristics in addition to hosting a great deal of research activity. These include:

- building an institutional infrastructure or culture that strategically encourages and supports faculty to pursue commercialization of viable discoveries and inventions
- creating adequately funded, autonomous technology transfer offices (TTO) run by staff with strong business and science backgrounds, and
- using activity-based, rather than financial metrics to measure the success of the TTO.

Further, those institutions that do this well tend to view creating wealth and driving business creation as part of their mission and are confident in their ability to contribute to both. Their leaders are actively engaged in the business and civic communities and have a regional presence.

**Clustered Office and Laboratory Space**

Technology startups require access to office and lab space that meets their specific needs. Beyond specific laboratory and technical requirements, they need affordable, flexible, short-term leases in buildings with secure 24-hour access. And of course, the real estate axiom that “location is everything” comes into play as well. Office space needs to be conveniently located close to relevant research institutions as well as amenities like restaurants, retail and even housing. In some successful urban
innovation centers, the institutions themselves have taken an active role in creating office and lab space tailored for startups as well as housing and retail.

However, simply creating office and lab space is not enough. Urban innovation centers must offer companies a good value proposition. Geographic concentrations of interconnected firms and supporting organizations facilitate the delivery of services and, more importantly, the exchange of ideas to spur business growth.¹ When this happens, clusters of specific industries often begin to develop. Such clustering increases productivity and contributes to a thriving economy.

Such dynamic networks are self-perpetuating – once formed, both startups and established firms look to locate within these clusters to reap the benefits, which typically include access to relevant research, goods and services, talent, and capital.²

Typically, urban innovation centers cannot compete on cost with comparable suburban and exurban space. Rather, companies that choose to operate in an urban center are willing to pay a premium to be located amidst a high concentration of researchers and other innovation-minded companies. The geographic footprint of a cluster can vary, but in successful urban innovation centers, they are generally concentrated within a square mile or two. Beyond formal collaborations and relationships made easier by co-location, clusters encourage casual interactions and allow for “bump and connect” opportunities.

**Critical Mass of Entrepreneurs and Capital**

Successful innovation centers develop and attract entrepreneurs, including serial entrepreneurs who, having had success in previous endeavors, will reinvest time and resources in new ideas and companies.³

Such entrepreneurs also attract venture capital – both the physical location of firms and the funding that they provide. Successful clusters are not only able to pull funding from firms located elsewhere, but they are seen as a place where venture capital firms need to be.

There is some debate about whether a critical mass of venture capital is a prerequisite for a successful innovation center or rather a sign of that success. In other words, does the money simply follow the good ideas? Good ideas certainly attract financing; however, relationships are important as well, and relationships are more likely to develop between entrepreneurs and venture capital managers in close proximity to one another.

**Entrepreneurial Culture**

This component is perhaps the most difficult of the five to define and certainly to measure. A culture that encourages entrepreneurship supports risk-taking and doesn’t look too harshly on the inevitable failures that risk-taking brings. It is an open and dynamic environment that allows for the sharing of ideas in informal and formal settings.

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¹ Definition from Brookings Institution’s “The New ‘Cluster Moment’: How Regional Innovation Clusters Can Foster the Next Economy” by Mark Muro and Bruce Katz.


One measure of entrepreneurial culture is the presence of active groups and organizations that provide a setting for budding and established entrepreneurs and investors to interact. In a booming center of innovation these groups will have well-publicized and well-attended meetings and events regularly, as often as every few days.

**Collaborative Leadership**
Successful innovation economies may develop somewhat serendipitously, but they don’t develop by chance. Beyond great research assets, they require engaged, entrepreneurial-minded institutional leadership to build and sustain a strong innovation-based economy. Broad collaboration is needed across educational institutions, health care institutions, foundations, and government and civic groups that invest time and resources in a number of ways. Whether by strategic real estate development or investment in innovation-based business development and the organizations that support it, these institutional leaders are outwardly engaged and embrace a broad institutional mission that includes having meaningful community impact.

With these five elements in mind, the Economy League turned to assessing the strategic position of University City as a center for innovation and developed three urban innovation center case studies highlighting the critical components of these centers’ successes and lessons for University City.
Part 2: The Current University City Innovation Story

Benchmarking analysis and interviews have revealed a set of contrasting realities in University City. There is a set of extraordinary strengths including world-class research institutions, but also very clear challenges which must be addressed in the development of an innovation center strategy for University City. In light of this, the Economy League has framed the University City story to highlight these contrasts and lay the groundwork for determining specific strategies for addressing gaps and challenges.

University City is currently a significant research engine ... but not a magnet for startups.

In 2010, academic institution research and development (R&D) spending in University City totaled $957 million, led by the University of Pennsylvania, which spent $836 million. When Children’s Hospital of Philadelphia ($250 million), Monell Chemical Senses Center ($11.5 million), and The Wistar Institute ($36 million) are included, total research spending in University City was over $1.2 billion.

Within the Greater Philadelphia region, University City academic institutions account for 59% of research and development spending. Outside of University City, leading academic institutions in research and development spending include the University of Medicine and Dentistry of New Jersey ($230 million) and the University of Delaware ($125 million). Temple University and Thomas Jefferson University spent $124 million and 103 million respectively.4 This strong research foundation has not, however, resulted in a level of commercialization on par with other leading regions and research institutions. Technology transfer figures from the area’s key institutions illustrate this. As Figure 1 shows, in 2010, 12 startups were formed from University City-based institutional research, and a total of 103 patents were issued to University City institutions or their researchers. By way of comparison, MIT alone had 16 startups and 166 patents issued in 2010.

University City Technology Transfer Statistics, 2010

<table>
<thead>
<tr>
<th>Institution</th>
<th>Licenses &amp; Options Executed</th>
<th>Startups</th>
<th>Invention Disclosures</th>
<th>Patents Issued</th>
<th>License Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Penn</td>
<td>87</td>
<td>9</td>
<td>373</td>
<td>64</td>
<td>$11,200,000</td>
</tr>
<tr>
<td>Drexel University</td>
<td>18</td>
<td>3</td>
<td>110</td>
<td>22</td>
<td>$816,218</td>
</tr>
<tr>
<td>CHOP</td>
<td>9</td>
<td>-</td>
<td>50</td>
<td>5</td>
<td>$265,975</td>
</tr>
<tr>
<td>Wistar Institute</td>
<td>16</td>
<td>-</td>
<td>7</td>
<td>12</td>
<td>$13,223,000</td>
</tr>
<tr>
<td>Total</td>
<td>130</td>
<td>12</td>
<td>540</td>
<td>103</td>
<td>$25,505,193</td>
</tr>
</tbody>
</table>

Source: University of Pennsylvania, Drexel University, CHOP, Wistar Institute

Note on presentation of University City Data

While this project focuses on University City, successful urban innovation centers require assets and activities in the larger region that provide other types of space and resources (workforce in particular) for constantly changing, growing companies. When considering how University City fares regarding the five key elements identified earlier, both University City and regional data have been included where available and appropriate.

4 2010 spending figures from the National Science Foundation
Most importantly, this research activity has not led to the establishment of a thriving cluster of startups or drawn many established companies to locate in University City. Further, the biotech companies currently located in the region are primarily in the suburbs rather than University City – a fact noted in interviews with several stakeholders.

Still, with more than 55,000 private-sector jobs, University City is a large center of employment, and the locus of education and health care employment in the region. As Figure 2 shows, jobs in education and health care dominate, comprising 80% of private sector employment in University City.5

Private Sector Employment in University City, Philadelphia, and the Region, 20086

<table>
<thead>
<tr>
<th>Sector</th>
<th>University City</th>
<th>Philadelphia</th>
<th>Region</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Jobs</td>
<td>Percent of Jobs</td>
<td>Percent of Jobs</td>
</tr>
<tr>
<td>Financial Services &amp; Real Estate</td>
<td>1,151</td>
<td>2.1%</td>
<td>8.9%</td>
</tr>
<tr>
<td>Management, Professional, &amp; Technical Services</td>
<td>1,827</td>
<td>3.3%</td>
<td>11.7%</td>
</tr>
<tr>
<td>Information</td>
<td>333</td>
<td>0.6%</td>
<td>2.8%</td>
</tr>
<tr>
<td>Administration &amp; Support</td>
<td>1,087</td>
<td>2.0%</td>
<td>4.7%</td>
</tr>
<tr>
<td>Educational &amp; Health Services</td>
<td>44,636</td>
<td>80.9%</td>
<td>33.5%</td>
</tr>
<tr>
<td>Leisure &amp; Hospitality</td>
<td>3,346</td>
<td>6.1%</td>
<td>10.3%</td>
</tr>
<tr>
<td>Retail Trade</td>
<td>1,049</td>
<td>1.9%</td>
<td>9.1%</td>
</tr>
<tr>
<td>Manufacturing &amp; Construction</td>
<td>513</td>
<td>0.9%</td>
<td>7.7%</td>
</tr>
<tr>
<td>Wholesale, Transportation, &amp; Utilities</td>
<td>337</td>
<td>0.6%</td>
<td>7.1%</td>
</tr>
<tr>
<td>Other Services (Excluding Public Administration)</td>
<td>908</td>
<td>1.7%</td>
<td>4.1%</td>
</tr>
<tr>
<td>Total</td>
<td>55,187</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: Center City District: Philadelphia’s Major Employment Nodes, 2010

The employment numbers in Figure 2 do not provide information about innovation-based employment. Due to the small size of University City, employment data at that level of detail is not available through public or privately developed databases. The best available estimate of innovation-based jobs does, however, show that there is indeed room for growth in University City. As of 2009, there were approximately 2,000 private sector jobs in innovation-based companies and research institutes in University City.7 More than half of these jobs (1,270) were attributable to biomedical or biotechnology firms or institutes, with the remainder in sectors including information technology and business services.

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5 University City is defined as an area encompassing three zip codes – 19104, 19139, and 19143. Geographic boundaries are, on the east, 29th Street and the Schuylkill River; on the west, 50th Street; on the north, Spring Garden Street (to 40th Street), Powelton Avenue (to 44th Street), and Market Street; and on the south, Civic Center Boulevard, University Avenue and Woodland Avenue.

6 2008 is latest year for which data is available at a neighborhood level

7 Because reliable employment or firm data is not available, the above estimate is based on employment data from the Science Center, Cira Centre, and The Wistar Institute with the assumption that they comprise the vast majority of private innovation-based employment in the area.
Underscoring the role of regional business incubation in this arena, nearly 1,300 of these jobs were created by 15 companies previously incubated at the Science Center and around 175 were employed at current incubator companies.

Recognizing the potential to improve technology transfer and employment figures, research institutions in University City are already working to increase technology transfer capabilities and to encourage startups and established innovation-based companies to locate in the neighborhood.

During interviews, technology transfer and research leadership at Penn, Drexel, and CHOP discussed recent and planned measures they have taken to boost commercialization, including increasing tech transfer office (TTO) funding, adding TTO staff with strong entrepreneurial backgrounds, proactively reaching out to faculty and researchers, and working to build an institutional culture that supports commercialization and encourages entrepreneurship. In late 2007, Penn brought in new TTO leadership and since then has restructured the TTO, increased staff, and changed hiring practices. More recently, Drexel President John Fry announced plans to increase the university’s focus on research, including adding four new positions in the TTO, which would nearly double the number of office staff.

In spite of these efforts, stakeholders did point to a number of concerns regarding the state of technology transfer at University City institutions. They cited challenges around the bureaucracy of the institutions, lack of integration across research areas and departments, and too little focus on tech transfer from top administrators. Some also noted a need for more autonomy for tech transfer staff to ensure that their professional expertise guides decisions about patents and other tech transfer issues rather than internal politics and relationships.

**University City has improving amenities and sense of place ... but limited opportunities exist for private office and lab development that would foster innovation-based economic growth.**

University City offers unique accessibility and a good and improving quality of life to residents and businesses in the area. The neighborhood is well-served by public transit, and leaders have been successful in bringing retail, restaurants, and other services to University City. In fact, retail growth in University City has outpaced that of Center City in recent years, increasing by 11% from 652 to 724 establishments between 2006 and 2009. The residential population of the neighborhood has grown as well. While the growth was a relatively modest 1% between 1990 and 2009, University City stands out as an area of growth in a city that overall lost population during that time.  

While the neighborhood still struggles with underperforming K-12 schools and public safety challenges, institutions and businesses have made significant, effective investments in the neighborhood, including supporting the University City District, a special services organization focused on improving quality of life that has overseen the investment of $4 million in neighborhood improvements. The University of Pennsylvania’s successful work with the Penn Alexander Elementary School has made the school’s

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8 University City population and business growth figures taken from the *State of University City 2010* report produced by the University City District.
catchment area one of the most desirable in the city, and Penn has become a national model for institutional community engagement as well as university-led retail development.

The Market Street corridor along which the Science Center campus runs has long been in need of improvements. Described as sterile and inhospitable in interviews, there was excitement around the recent improvements made by the Science Center and a number of partners including the City of Philadelphia and the University City District. The facelift, which was completed in 2010 along Market Street between 34th and 41st Streets, includes landscaping, benches, bicycle lanes, and improved lighting, sidewalks, and crosswalks. Concerns remain about the appearance and general lack of vitality around the 34th Street subway station, which serves as the eastern gateway to the corridor and the Science Center campus. The importance of improving this area was mentioned in multiple interviews and meetings.

While academic and research institutions have used their own funds to seed retail development in University City, there have been no similar efforts to develop commercial office or lab space, beyond investment in the Science Center. Institutional land needs and existing residential corridors leave little room for private development. Additionally, interviewees cited the conservative real estate market in Philadelphia as an obstacle to getting new facilities underway without pre-leases.

Privately-owned, commercial office space in University City is limited to the Science Center, Cira Centre, and at 3535 Market Street, which is on the Science Center campus but owned by Israel-based real estate firm Gazit. This represents a combined total of 2 million square feet that is currently at more than 90% occupancy. The tenant mix is dominated by institutional tenants (universities and hospitals), and also includes entrepreneurial and established companies, organizations and startups in the Science Center’s Port business incubator. As Figure 3 shows, University City boasts the lowest office vacancy rate in the city and one of the lower rates in the region.

**Vacancy Rates for Select Office Submarkets, 2012 Q1**

<table>
<thead>
<tr>
<th>Submarket</th>
<th>Vacancy Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southern 202 Corridor</td>
<td>5.6%</td>
</tr>
<tr>
<td>Radnor/Main Line</td>
<td>5.8%</td>
</tr>
<tr>
<td>University City</td>
<td>9.0%</td>
</tr>
<tr>
<td>CBD-East Market</td>
<td>11.1%</td>
</tr>
<tr>
<td>Conshohocken</td>
<td>12.0%</td>
</tr>
<tr>
<td>CBD-West Market</td>
<td>15.0%</td>
</tr>
<tr>
<td>CBD-Independence Square</td>
<td>16.2%</td>
</tr>
<tr>
<td>King of Prussia</td>
<td>18.7%</td>
</tr>
<tr>
<td>Wilmington CBD</td>
<td>20.9%</td>
</tr>
</tbody>
</table>

*Source: Grubb and Ellis*

Because so much of the demand is driven by institutions, interviewees were divided on the demand for additional space in spite of the low vacancy rate. However, if University City is going to become a center for innovation-based companies, more office and lab space is clearly needed, and once the Science Center’s available parcels have been developed, finding the land on which to build those facilities may pose as daunting a challenge as financing actual development.
Educational and health care institutions, economic development organizations, community-based organizations, and private developers all have a role to play in finding creative and flexible options for increasing office and lab space and ensuring a quality of place that attracts companies and entrepreneurs. Stakeholders have an opportunity to work with the Philadelphia City Planning Commission around implementation of Philadelphia 2035, the first city-wide comprehensive plan since 1960. The plan identifies several industrial areas near University City for redevelopment as office and research and development facilities.

Future efforts must take into consideration the value proposition for companies and entrepreneurs considering University City. From a regional perspective, University City is expensive. Average rents in University City are $35/square foot compared to $27 in the City of Philadelphia as a whole and $26 in Exton/Malvern. While rental rates are the main cost driver for companies, taxes do have an impact on cost as well, and city wage and business privilege taxes hurt University City’s competitiveness. Because University City cannot compete within the region on costs, it must offer density of related businesses, accessibility to researchers and like-minded entrepreneurs, as well as great services and amenities.

*University City has considerable strength in life sciences ... but no other major innovation clusters that result in a steady stream of licensing and startups.*

According to a 2009 Milken Institute study, Greater Philadelphia’s life sciences cluster is second only to the Boston region. The region’s strength is attributed mainly to its university and hospital research infrastructure, much of which is in University City, and the presence of pharmaceutical companies, which are primarily in the suburbs. More than $724 million, or approximately 76%, of research and development spending at University City academic institutions is focused on life sciences annually. When CHOP, Wistar, and Monell are included, the share is closer to 85%. Penn routinely tops the list of institutions awarded National Institutes of Health funding. Funding for engineering research comes in a distant second in University City academic institutions at $80 million, or 8%, of total spending.

Figure 4 shows academic institution R&D spending for University City, Greater Philadelphia, and the regions selected for case studies in this report. Philadelphia, Boston, and the Bay Area each have significant strength in the life sciences sector. However, spending in Boston and the Bay Area is more balanced than in Philadelphia. In Boston, the life sciences share is 44% and in the Bay Area it is 66%. This balance is important in developing and supporting a more diverse, multi-sector innovation-based economy.

Clearly, capitalizing on the region’s life sciences strengths and continuing to grow assets in this cluster is a key component of any innovation-focused economic development strategy for Greater Philadelphia. However, the most successful centers of innovation have multiple areas of strength and tend not to be overly-dominated by one sector, leaving them better prepared for the inevitable fluctuations and shifts that impact dynamic and evolving innovation economies. In Cambridge, for instance, biotech accounts for around half of the innovation economy, with IT, clean tech and other sectors filling out the other half.

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9 These totals include only academic spending in order to provide a region-to-region comparison.
Other current research strengths in University City include communications, information technology, and nanotechnology. The 2010 award of more than $120 million in federal research funding to the Energy Efficient Buildings Hub at the Navy Yard will lay the groundwork for a new and growing clean tech innovation cluster. While not located in University City, this investment stands to benefit the entire region. These areas present excellent opportunities for further specialization and commercialization. Beyond diversifying the innovation economy, these other sectors often require less investment and a shorter time frame to bring research to market. By comparison, commercialization efforts in the life sciences sector have become increasingly expensive and risky while taking significantly longer to move from research and discovery to a marketable invention.

**University City has an impressive history of research discovery and innovation ... but these accomplishments are underappreciated and under-marketed.**

University City has been home to a stunning amount of discovery. The first computer, ENIAC, was invented at Penn in 1946. CHOP researchers developed vaccines for whooping cough, mumps, rubella, influenza, and more recently rotavirus. The size and strength of University City’s research institutions is exceptional. In addition, major business success stories including Centocor, SEI Investments, and Avid Radiopharmaceuticals have their origins in University City. Unfortunately, this track record often goes unnoticed both inside and outside the region, as University City lacks an innovation center brand that brings together its considerable assets and accomplishments. This low profile hurts University City’s and the region’s ability to grow and attract both entrepreneurs and the venture capital on which they rely.

A 2009 report prepared for the Science Center by the Economy League of Greater Philadelphia outlined the economic impact of Science Center-incubated companies on the region. These companies have created $9 billion in annual economic output, 15,000 direct jobs, and 42,000 indirect jobs. The impact of many of these companies goes well beyond our regional economy as they are bringing valuable discoveries and technologies to the market.
Greater Philadelphia has a growing entrepreneurial community ... but limited venture capital resources and too few serial entrepreneurs.

The entrepreneurial community is growing in Philadelphia, but lacks a critical mass of experienced executives with startup experience. Compared to other top innovation economy regions, Greater Philadelphia has a relatively small pool of CEOs that have progressed from one endeavor and moved on to form or invest significantly in a second or third venture – an important cycle for establishing a thriving innovation economy. This dynamic is, in part, a result of the region’s focus on large pharmaceutical and medical devices firms, which generate entrepreneurs at a lesser rate than biotech-focused economies. This issue was mentioned by multiple stakeholders during interviews. While employees of these firms have excellent skill sets that contribute to the region’s strength in life sciences, they will not be a significant source of entrepreneurial energy for the region.

The region does have a healthy network of formal and informal organizations and groups that support budding entrepreneurship. Organizations like Ben Franklin Technology Partners, BioAdvance, Greater Philadelphia Alliance for Capital and Technology (PACT), Dreamit Ventures, and the Science Center provide a network of services and funding opportunities for researchers and entrepreneurs. A number of interview subjects noted that, in light of improved relationships with institutions and expanded programming, the Science Center is well positioned to impact University City’s innovation economy.

Groups and organizations like Philly Startup Leaders and Technically Philly provide networking and information on entrepreneurial opportunities. In addition, universities have taken steps toward encouraging and supporting faculty in commercialization and entrepreneurship efforts.

A continuing challenge to this developing entrepreneurial culture is a lack of venture capital, particularly early-stage capital. In interviews, stakeholders discussed this issue extensively, stating that by and large, Philadelphia does not attract the attention of venture capital and that this lack of recognition creates real hardship for local startups and drives away entrepreneurs. While the dollar amount has fluctuated considerably year to year, the share of venture capital raised by companies in the region was 2.6% ($11.8 billion) of total US venture capital investment from 1995 to 2010. By way of comparison, during the same time period, the New England area raised 12% (driven primarily by Boston) and Silicon Valley raised 34% of the US total. In 2010, Greater Philadelphia-area companies raised $431 million (2.4%). Significant declines were seen across all regions between 2008 and 2009, as the economic crisis caused the total amount of venture capital invested to plummet from $28 billion in 2008 to $18 billion in 2009.

In University City, companies located in the Science Center Port business incubator raised approximately $80 million between 2006 and 2010. These investments, of course, do not include liquidity events, such as the recent sale of Avid Radiopharmaceuticals for up to $800 million.

Figure 5 shows how Greater Philadelphia compares to several other regions with respect to venture capital funding. Silicon Valley and New England have not been included as they are literally off the charts in comparison to other regions. New England companies raised between $3 and $5 billion annually and Silicon Valley $7 to $12 billion annually between 2001 and 2010.
Clearly, the region needs significant growth in venture capital if it is going to compete with neighboring regions. Southeastern Pennsylvania has important assets in BioAdvance and Ben Franklin Technology Partners, both of which use public dollars to provide early-stage funding to entrepreneurs. These efforts are crucial to growing the innovation-based economy in the region. The Science Center and its institutional partners have also made an effort to address the significant existing gap in proof-of-concept funding for promising discoveries through the new QED Program. As of January 2012, the QED Program had awarded $2.4 million in four funding rounds to life sciences technologies with market potential. The $1 million grant awarded the program from the U.S. Economic Development Administration assisted with its launch, but this resource needs to grow significantly if it is to have a broader impact.

The existing funding gap, however, will not be closed through institutional or public dollars, particularly given the budget challenges facing the Commonwealth. At best, these funding mechanisms can be used as leverage to assist early stage companies and attract private capital.

**Conclusion**

As this analysis shows, many of the building blocks of a successful innovation center are present in University City, but gaps and challenges remain. While identifying these gaps and challenges is relatively straightforward, formulating effective strategies for addressing them presents a more challenging task. To begin this process, Part 3 of this report provides in-depth analysis of three urban innovation centers and focuses on strategies and actions that have resulted in successes and lessons for University City.
Part 3: Case Studies

The University City Innovation Collaborative chose three diverse urban centers as case studies to understand the approach of different communities in nurturing an innovation-based economy. Cleveland represents a former manufacturing powerhouse with a nearly forgotten history of innovation that leaders are working to resurrect; Mission Bay in San Francisco, a new development, is an example of how leadership is constructing a new community and innovation cluster from whole cloth; and Cambridge is a well-oiled innovation machine that is nurtured by entrepreneurial institutions.

Cleveland: Collaborative Leadership around Well-Defined Goals

While Cleveland’s recent history does not bring to mind innovation or a thriving economy, it is working to change that. Over the last 10 years, a consortium of leaders from academic and health care institutions, foundations, and state and local governments have come together in an effort to address the economic challenges facing the Greater Cleveland region. Recognizing that Cleveland’s history as a manufacturing giant is just that – history – leaders are trying to capitalize on the presence of world-class institutional anchors like the Cleveland Clinic and Case Western Reserve University as well a concentration of polymer research and manufacturing expertise to rebuild the thriving, innovative economy that drove the region through much of the 20th century. The region’s rich network of foundations, health care and higher education institutions, the State of Ohio, and others are playing a significant role in these efforts.

Sustained Focus on Business Growth

Cleveland’s current efforts around innovation are a continuation of the region’s rich history of civic leaders coming together to address challenges and make the region a better place to live. Stakeholders trace ongoing focused efforts to spur innovation-based economic growth to a 2001 Cleveland Plain Dealer and Cleveland Public Radio and Television series of articles, broadcasts, and events about the economic challenges facing the region. This series, dubbed “A Quiet Crisis,” highlighted the need for civic engagement around regional economic development.

Historically, economic development had been not a major area of grant-making for foundations. However, they did see the opportunity to help rebuild the region through investments in economic development grants were envisioned as core investments that, if properly made, could reduce the need for foundation support to prop up areas such as the arts and education.

Recognizing their relative lack of experience in grant-making in the economic development sphere and the need for large, coordinated investments to affect real change in this arena, 60 of the region’s private and corporate foundations and institutions came together to systematically identify priorities and pledged funding to tackle them. The result was a detailed and well-funded economic development plan entitled Advance Northeast Ohio, to be implemented in part by a new organization, The Fund for Our Economic Future, created in 2004.
The Advance Northeast Ohio plan focuses on four major priority areas: business growth and attraction, talent development, racial and economic inclusion, and government collaboration and efficiency. The plan was drafted based on recommendations from a Cleveland State University study on economic indicators for the region as well as input from 20,000 residents who participated in extensive public forums on economic development priorities. The Fund is implementing this plan primarily through grant-making to established organizations, but also through continued research and civic engagement.

The Fund’s partners initially pledged a minimum of $100,000 each over a three-year period. The Fund grants approximately $10 million annually to a host of organizations that work in discrete and complementary ways to build the innovation economy in Cleveland. These include organizations that help attract, form, and accelerate innovation-based businesses, provide access to venture capital and incubator space, and identify and nurture emerging innovation-based clusters. The Fund also supports several regional initiatives including efforts around life-long learning, efficient local government, and regional infrastructure needs.

When it was established, the Fund drafted a nine-year timeline – three phases, lasting three years each, with each phase having a specific area of focus. During the first two phases (2004-2006 and 2007-2009), the Fund worked primarily on business growth and attraction and on laying the groundwork for a self-sustaining network of organizations that could nurture innovation-based economic growth beyond the life of the Fund. At the conclusion of phase three, the Fund is to cease being a major grantor to these organizations.

The Fund has seen significant success, citing $78 million in new annual payroll taxes, $106 million in state investment, and $571 million in venture capital in the region as of February 2010 as a result of grantee efforts. Challenges remain, however, in evaluating their success in establishing self-sustaining networks that can thrive in the absence of financial support provided by the Fund. While some Fund partners are willing to continue investing in the efforts, others, including the largest foundation in the region – The Cleveland Foundation – have begun pulling back from the partnership.
Building and Branding the Health-Tech Corridor

Among the most visible efforts around innovation-based economic development in Cleveland is the establishment of the Cleveland Health-Tech Corridor, a five-mile area centered on Euclid Avenue just east of downtown. Anchored by four world-class education and health care institutions, including the Cleveland Clinic, University Hospitals, Case Western Reserve University, and Cleveland State University, the corridor is currently home to more than 75 biotechnology companies, 45 technology companies and seven business incubators. Medical device companies and IT (including healthcare IT) constitute the majority of companies, but pharmaceutical companies and venture capital firms have also set up shop including Johnson & Johnson Development and Michigan-based Arboaretum Ventures. There are 50,000 biomedical and health care employees in the corridor and around 40,000 students.

The Health-Tech Corridor is a prime example of the collaborative leadership that has been so effective in Cleveland. It is managed jointly by two organizations - MidTown Cleveland, Inc., an economic development corporation, and BioEnterprise, a business formation, recruitment, and acceleration initiative. The health systems and educational institutions are engaged with the corridor via their involvement with BioEnterprise. Additional corridor partners include Team NEO (a business attraction organization), the Cleveland Foundation, the City of Cleveland, and the Greater Cleveland Partnership. The Greater Cleveland Partnership (GCP) is the regional chamber of commerce and yet another example of successful collaboration in the region. GCP was created in 2004 through the consolidation of three regional economic development/business advocacy groups with the goal of better allocating funds and committed leadership to improve the regional economy.

Thanks to this network of partners, the Health-Tech Corridor can provide companies with a full complement of services including business development support, real estate assistance, and connections to additional resources available through corridor institutions and organizations.

The corridor has also secured significant investments from the State of Ohio, including $200 million to build research capacity at the corridor’s institutions from Ohio Third Frontier, a $2.3 billion state initiative aimed at boosting the innovation-based economy. In 2010, the Health-Tech Corridor was named an Ohio “Hub of Opportunity and Innovation,” a designation that conveys priority status for millions of dollars in grants and loans that state agencies give out each year, as well as a $250,000 matching grant. At the local level, real estate projects and new business efforts along the corridor have already drawn some $25 million in grants and loans from the city.

In spite of these successes, the corridor does face a challenge in building density, which includes not only office and lab space for private companies, but the amenities that employees desire – restaurants and retail. On a positive note, space is not an issue. The Health-Tech Corridor includes a significant number of empty buildings and lots on which to build. Private developers are active in the area and have received assistance from the city and the state. These developers are creating post-incubator office and lab space for private companies. Leaders point to public subsidies as crucial to making these developments work.

Significant infrastructure investments have been made in the corridor, including new water and sewer lines, improved streetscapes, and the establishment of the Health Line, a rapid transit bus service running along Euclid Avenue. While these infrastructure improvements were necessary to facilitate
growth along the corridor, they have had the short-term impact of driving traffic away from the corridor, causing some businesses, among them the retail and restaurants so desired, to struggle or even go out of business. Leaders are looking at ways to encourage traffic to return, but this remains a challenge, and underscores the need for a long-term vision and specific plans in making a project like the Health-Tech Corridor work.

**Attracting Capital and Making Deals**
The region has made a concerted effort to increase the amount of capital available to local companies both by drawing it from outside the region and by creating new sources within the region. Key institutions like Case Western and Cleveland Clinic, as well as the State of Ohio, have invested time and money in these efforts.

Two of the leading organizations working on this are BioEnterprise and JumpStart. Both are nonprofit and count multiple major regional institutions as partners or investors. BioEnterprise works to attract, create, and grow companies in the medical device, biotechnology, and health care service sectors. Each year, they choose a small number of companies and work very closely with them, utilizing the resources and networks of BioEnterprise’s partners to provide them with a host of important resources, including management guidance, connections to research and clinical institutions and to venture capital, and access to a network of technical services, equipment, and flexible development space.

When BioEnterprise was founded, its leaders set specific benchmarks for attracting capital. The first was to match the amount of venture capital investment in Cleveland to that received by the Research Triangle area within five years. They met this benchmark and along the way identified other issues faced by entrepreneurs and fledgling companies. These issues were beyond the province of any one institution and required collaborative effort that they were able to harness given the extensive working relationships around the innovation economy. They are now looking to the next benchmark – matching the Minneapolis region in venture capital funding.

JumpStart is a nonprofit venture capital firm. Different from traditional firms, they provide intensive entrepreneurial assistance and selectively invest in the highest potential companies through one of several capital programs they operate. JumpStart also works extensively on marketing the region with the goal of encouraging both entrepreneurs and investors to consider Cleveland when looking to develop a business or invest.

Both BioEnterprise and JumpStart point to their focus on market demands, those technologies and companies which fill the expressed interests of investors, as crucial to their success. To do this, they invest significant time in meeting with and listening to investors.

Another important component is the time and resources they put into working with companies selected to receive funding and technical assistance. JumpStart works one to two days per week with selected companies for up to two years, and BioEnterprise companies receive management guidance provided by experienced bioscience professionals.
A Strong Network of Organizations
A number of the organizations working on the innovation economy in the region have been previously mentioned. However, it’s worth taking stock of the central organizations, the roles they play, and the rich network that they comprise.

BioEnterprise – business acceleration

- Founders and partners are Cleveland Clinic, University Hospitals, Case Western Reserve University, Summa Health System and BioInnovation Institute in Akron. Additional technology partners include the NASA Glenn Research Center, Cleveland State University, NorTech, and BioOhio (a state bioscience membership and development organization).
- Comprises the collective activities of BioEnterprise and its partners’ commercialization offices: the Case Office of Technology Transfer, Cleveland Clinic Innovations, University Hospitals Case Medical Center - Center for Clinical Research and Summa Enterprise Group.
- BioEnterprise provides companies with management guidance, provides access to research and clinical institutions and bioscience venture capital, and a network of technical services, equipment, and professional service providers and flexible development space.
- Since 2002, BioEnterprise has created, recruited, and accelerated more than 90 companies that have attracted over $1 billion in new funding, assisted with collection of $150 million in revenues for technology transfer offices, and concluded 450 tech transfer deals.

Fund for Our Economic Future – visioning and funding

- Consortium of more than 60 private and corporate foundations and institutions, each of which pledged at least $100,000 over three years to support the Fund and the region’s economic development plan. Since 2004 the Fund has raised more than $70 million.
- Focuses on four priority areas: business growth, talent development, racial and economic inclusion, and government efficiency and collaboration. More than 80% of funding to date has gone to business growth efforts.
- Grantees include BioEnterprise, JumpStart, NorTech, Team NEO (broad business attraction), and MAGNET (Manufacturing Advocacy and Growth Network).

JumpStart, Inc. – capital and entrepreneurial development services

- Founded by NorTech and Case Western and funded by the state through the Ohio Third Frontier program (50% of funding) and private philanthropy (50% of funding).
- Provides seed capital, experienced advisors, and a network of vital resources to high potential companies. When investing in a company, JumpStart works with them one to two days a week for up to two years.
- Since 2004, has invested $20 million in 52 companies, which have raised over $140 million in follow-on capital, leading to the creation of over 800 jobs and economic impact of over $267 million.
The federal government has taken note of JumpStart’s success, awarding them a $2 million grant through the US Department of Commerce to help other Midwestern communities design their own programs for supporting entrepreneurs and early-stage companies. More recently, JumpStart America was established to partner with the Startup America Partnership, an alliance formed in response to a call for action from the Obama administration to increase the development, prevalence and success of innovative, high-growth US startup firms.

**MidTown Cleveland – place-based economic development**

- Economic development corporation supported by member organizations, including private companies, foundations, and institutions in the Midtown area, as well as grants from local foundations and government programs.
- Focuses on a two-mile area that overlaps with the Health-Tech Corridor and works in conjunction with BioEnterprise to support the corridor.
- Works on master planning the midtown area, transportation issues and brownfields remediation, and administers city’s Empowerment Zone and Storefront Renovation programs.

This section does not highlight every organization that comprises this network. A few that deserve brief mention are NorTech, a “high-tech” chamber of commerce that tracks macro trends to help form and catch new clusters that have promise, Team NEO, a general business attraction organization, and MAGNET, which assists manufacturing companies in implementing innovative strategies and techniques and manages a business incubator.

**Common Focus on Goals, Marketing, and Strategies**

Cleveland’s efforts around the innovation-based economy are notable for a number of the reasons previously mentioned, but perhaps most remarkable is the strong sense of unity among leaders of these efforts. They have settled on specific goals and complementary strategies and stayed focused and on message. They identified two major areas of focus for innovation-based growth based on existing industry strengths and anchor institutions: medical technology and polymers.

Not only does this focus allow them to target local and regional resources, they are able to speak with a united, strong voice when advocating for state support. As a result, the region has secured crucial support including major infrastructure improvements, a new bus line, and support for research at institutions in the Health-Tech Corridor.

Foundation and institutional leadership have bought into this common vision with both time and money. Despite early successes and a strong network of organizations, changes in leadership could fragment and dilute these innovation growth efforts going forward.

**Cleveland’s Keys to Success and Lessons for University City**

Although the Cleveland story is a work in progress, regional leadership has set in motion a well-coordinated and focused strategy to expand the innovation-based economy. The following points represent important lessons from their journey.
Ambitious planning with broad leadership buy-in

Major regional institutions including the Cleveland Clinic and Case Western and more than 60 area foundations including the Cleveland Foundation came together in an unprecedented collaboration to address economic development with a specific focus on growing the innovation-based economy. By pooling resources in an independent fund, they have been able to pursue a fully coordinated agenda and to fund efforts at a level that has meaningful impact.

The Cleveland experience underscores the impact that broad leadership engagement could have in University City and the Greater Philadelphia region. The University City Innovation Collaborative has worked to engage leadership across sectors and geographic lines, and should continue to do so.

High-capacity, networked organizations

Cleveland has a network of organizations that are working in concert to build an effective innovation economy infrastructure. Together, these organizations provide a full complement of services to assist innovation-based companies and support commercialization of technologies.

Greater Philadelphia is fortunate to have a number of effective innovation-based economic development organizations. The next step is better interaction among these groups, particularly as resources available for these efforts shrink with reduced state and federal budgets.

Clear focus on targeted industries and specific goals

Based on existing strengths and resources, two specific sectors were selected for focus - medical technology and polymers. Leaders created a consistent message around developing these sectors. Support organizations also set specific benchmarks to gauge progress toward growing the innovation economy, such as raising an amount of venture capital that exceeds competitor regions.

As the University City Innovation Collaborative moves forward, setting ambitious and specific targets will be important to illustrating progress and ensuring buy-in from key institutions.

Marketing underappreciated resources

Cleveland is not generally thought of as hotbed of innovation or successful economic development. Leaders recognize this and have focused on marketing the specific, world-class assets that are in the region including Cleveland Clinic, Case Western, and University Hospitals, in addition to branding and marketing these assets together under the umbrella of the Health-Tech Corridor.

Philadelphia faces similar perception challenges. An important component of the University City Innovation Collaborative’s efforts will be to compile innovation success stories highlighting discoveries and businesses that have emerged from University City. In the longer term, a specific branding strategy for University City should be pursued.
Mission Bay: Development from the Ground Up

The Bay Area is a hotbed of innovation with booming biotech, IT, and clean energy economies. However, for a variety of reasons, most of this activity has been outside the boundaries of the City of San Francisco. But in the late 1990s, when the city was faced with the threat of losing the University of California San Francisco (UCSF) campus, it responded with a solution that not only secured the continued presence of the campus in the city, but also paved the way for startups and established biotech firms to locate within the city.

To do this, the city utilized creative financing, flexible zoning, and public-private partnerships to get development of the Mission Bay neighborhood underway. The project was a large-scale, comprehensive redevelopment of cleared land, including new construction of basic infrastructure components like streets and sewers, making it a particularly interesting and somewhat unusual subject for a case study. UCSF, in partnership with several other agencies and groups, established an incubator that provides space and support for entrepreneurs, and private developers have been busy building space for tech companies looking to be close to UCSF and housing for those companies’ employees. Although the economic downturn hampered growth somewhat, significant development has taken place.

Story of Mission Bay

Mission Bay is a 300-acre parcel of land that was an active rail yard through World War II. With the decline of rail transport and the movement of industry and people out of the city to the suburbs, the area languished, unused, contaminated, and cut off from the rest of the city by a highway and train tracks. The final redevelopment plan, adopted in 1998, was the last of a series that had been put forward starting in 1981 and established a framework for redevelopment on a scope unseen in San Francisco in decades. The 300-acre space was planned from scratch – layouts for streets and sidewalks, new sewers, and utilities had to be created.

As the 17-year timeline indicates, this transformation did not come easily. A convergence of strong leadership and a pressing need to act to retain a major institution – UCSF – finally drove adoption and implementation of the 30-year plan. Further, the completion in 2000 of AT&T Park, home to the San Francisco Giants, helped to give the area an identity, which it had lacked, and continued development in the city was pushing towards Mission Bay’s borders, creating more life around the area.

Having outgrown its campus in the Parnassus neighborhood, UCSF was looking for a new home. Name notwithstanding, the university was considering moving outside the city to find adequate, affordable space. Keeping UCSF in San Francisco was important to the city for a number of reasons, but particularly given UCSF’s status as the second largest employer in San Francisco with more than 21,000 employees (only city government employs more people).

To retain UCSF in San Francisco, the city worked with Catellus, a private development corporation that owned much of Mission Bay, to arrange for 43 acres to be donated to the university for development into a biomedical research campus. Recognizing an opportunity beyond retaining UCSF, the city envisioned the campus as the anchor of a thriving bio-medical hub with office and lab space to accommodate research and private companies, retail and other amenities, and housing options. They
worked closely with Catellus and other private developers and the university to lay the foundation for this vision.

Mission Bay is now home to incubator space for startups, multiple venture capital firms, and established companies including FibroGen, Inc., Merck & Company, Celgene, and Genentech. It’s also home to the state-funded California Institute of Regenerative Medicine, a stem cell research facility, and construction of a 289-bed hospital began in late 2010. More than 3,000 housing units as well as retail and other amenities have been built.

At build out, envisioned as a 30-year process, Mission Bay will have 6,000 housing units, 28 percent of which will be affordable housing, 50 acres of park space, six million square feet of commercial space, and a hotel. Once the resident population reaches a certain level, a public school and fire and police stations are also planned.

**Dynamic and Collaborative Leadership**

The story of Mission Bay includes a cast of effective, creative, and well-connected leaders in the public and private spheres. Perhaps most importantly, these leaders worked collaboratively across sectors, soliciting input and relying on the expertise of other stakeholders when appropriate.

After attempts during three previous administrations, San Francisco Mayor Willie Brown (1996-2003) was able to get approval for a redevelopment plan, but to get actual redevelopment work underway. Key to this was the crafting of zoning regulations that facilitated private development and the availability of creative infrastructure financing.

The pressing need to find a new home for the city’s second largest employer certainly created a strong incentive. Mission Bay was one of the only options for a 43-acre development in such a densely populated city. Still, Mayor Brown is generally credited with being the driving force that made Mission Bay redevelopment a reality, and the city went much further than just keeping UCSF in the city, seizing the opportunity to establish the campus as an anchor for a burgeoning biotech hub. The goal was to develop a place that could compete with the suburbs by offering more density in an urban setting with amenities and proximity to research not available in suburban settings.

Ground was broken on the redevelopment project in 1999, and the UCSF Mission Bay campus opened in early 2003. Private investment followed in 2004 when Alexandria Real Estate Equities, a life sciences facilities developer, bought space to develop more than 1.4 million square feet of office and lab space.

Sworn into office in 2004, Mayor Gavin Newsom (2004-2010) was able to effectively build on the momentum created by the Brown administration’s redevelopment plan in several ways. He established the Biotech Advisory Council to advise the city on growing the biotech industry in San Francisco. The Bay Area has a deep well of biotech expertise, which Mayor Newsom tapped for his council. He included venture capitalists, lawyers, entrepreneurs, and academic leaders to serve on the council.

In addition to an aggressive marketing campaign aimed at biotech businesses, the city implemented a Payroll Tax Exemption for biotech companies and updated zoning codes to allow for more parking in the neighborhood, a request of potential biotech tenants. These changes are credited with bringing several of Mission Bay’s larger tenants like FibroGen.
Under Mayor Newsom’s leadership, the City’s Office of Economic and Workforce Development had dedicated business development staff working to see that Mission Bay development continued and attracted companies. Leadership in the office was engaged and connected with the biotech business community and responsive to their needs. When the need for incubator/early stage startup space was identified, the office worked closely with private companies, UCSF, and other partners to establish such space in Mission Bay.

While space for larger companies and startups has been created, a challenge remains in retaining startups as they grow into mid-sized companies. Currently, as those startups outgrow incubator space, they often relocate outside the city. Part of this is an issue of cost. Places like South San Francisco and Emeryville are less expensive than Mission Bay. For those companies looking to stay, however, finding appropriate space is a challenge. As of late 2010, the office was working to spur the development of space that works for companies across the startup life cycle.

An additional area in which effective leadership played a key role is in building and maintaining resident relationships. Prior to redevelopment, the neighborhood had only a few residents in a houseboat community. While the limited residential population meant that no one had to be displaced and obviously made the redevelopment easier, the city, developers, and community residents put significant effort in working together to best meet each party’s needs. This included considering the kinds of amenities longtime residents were interested in having in the neighborhood and issues around parking. Resident leaders and those involved on behalf of the city and developers credit their productive relationship to ongoing and open dialogue among all the stakeholders.

**Creative Public/Private Partnerships**

Successful public/private partnerships have been critical to laying the groundwork for a biotech hub at Mission Bay. As previously mentioned, Catellus is a private development corporation that, along with the city, were the landowners in Mission Bay. Not only did the city negotiate a deal with Catellus to donate land for UCSF’s campus, Catellus also agreed to make significant investments in the needed infrastructure utilizing financing tools of the City’s Redevelopment Agency, essentially, Tax Increment Financing (TIF). This is a financing tool allowed under California law. However, rather than the city providing the money for the improvements, Catellus funded the construction of streets, utilities, and sewers to the city’s specifications, at a cost of around $400 million. As property tax revenues in the neighborhood increase due to new development, those increases go toward reimbursing Catellus. However, if revenues don’t increase as anticipated and there is a shortfall, Catellus, rather than the city, is responsible for making up the difference.

Broad zoning was crucial to making this deal work, as it allows for developers to build office, research and development, life science, or commercial space, depending on the demands of the market. Rather than build, Catellus has been selling land to other developers including Alexandria and Shorenstein Properties.

In addition to attracting established companies to Mission Bay, the city, UCSF, and other stakeholders wanted to create an environment conducive to entrepreneurship and innovation-based startups. Toward this goal, they established the QB3 Mission Bay Innovation Center. Operating within the larger California Institute for Quantitative Biosciences (QB3), the network is a
public/private partnership among UC Berkeley, UC Santa Cruz, and UC San Francisco, the City of San Francisco, FibroGen, Alexandria Real Estate, the San Francisco Center for Economic Development, and the Chamber of Commerce aimed at spurring growth in the bioscience industry.

QB3 and the private partners in the QB3 Mission Bay Innovation Center provide tailored assistance to startups, including renting small amounts of space under flexible lease terms, access to scientific facilities at a discounted cost, a location near one of the world’s strongest bioscience universities and the seminars and symposia held there, access to UCSF’s libraries, and mentoring and business services.

The Garage, as the incubation space in the Innovation Center is known, has housed 12 companies since it opened three years ago. Four of those have received venture funding and one was acquired for $25 million. The center points to the diversity of partners - government, academic, nonprofit, and business - and the spectrum of services they are able to provide as crucial to the success of these companies.

UCSF: Life Sciences Powerhouse
While smart planning, strong partnerships, and good public policy have contributed to the success of Mission Bay, UCSF represents an equally, if not more important draw to companies. From the beginning, the campus was envisioned as an anchor, which would attract more investment and companies. Given the university’s track record, it is easy to see why.

UCSF is a major research university with a world-class record of research and development investment and patent generation. In 2006, the school was ranked second in the world for life science patents by a Milken Institute global survey, and it typically ranks second in overall R&D spending among US schools. UCSF R&D spending totaled just over $1 billion in 2010, and as of the same year, the school held 711 active patents and 347 active licenses, and claimed 78 life science startup companies.

The Mission Bay campus provides an opportunity for companies to locate near this significant research engine, something that was not possible at the Parnassus campus due to lack of space. At full capacity, the Mission Bay campus will have 9,000 scientists and technicians working there.

Beyond research, the culture of the university is one which is comfortable with entrepreneurship and industry relationships. Researchers move back and forth between UCSF and biotech companies and the school has relationships with companies including Pfizer and Genentech. In fact, the UCSF Chancellor, Susan Desmond-Hellmann, is a former Genentech executive.

Mission Bay’s Keys to Success & Lessons for University City
The City of San Francisco has seen significant progress toward making Mission Bay one of the Bay Area’s thriving biotech hubs. As the area grows and presumably attracts and incubates more innovation-based companies, several factors stand out as having been key to its success so far and in some cases, provide important takeaways for University City.
Dedicated Leadership

Mission Bay’s success is due in part to the priorities and actions of city leadership. Mayors Brown and Newsom recognized the value of innovation-based economic development. Given the impact it has had on the Bay Area’s regional economy, it is only logical that the city would look to attract and grow more of those activities. But more importantly than simply wanting this development, each of these mayors and their administrations understood how city policy and actions could support growth in the biotech economy and were able to enact effective policy to do so.

Engaged and focused leadership on the part of public officials could have a significant impact on University City. Similar to San Francisco and the Bay Area, many of the region’s life sciences companies are located outside the City of Philadelphia in surrounding suburbs where costs are generally lower. The City has a critical role to play along with the Science Center, University City institutions, private developers, and economic development groups in supporting a climate of innovation. Potential cooperative actions include targeted tax credits, partnering to develop office and lab space, and marketing efforts to attract entrepreneurs.

Creative and Responsive Planning

After 17 years of trying, the city finally developed a plan for Mission Bay that was both politically and financially feasible. Utilizing creative financing and flexible zoning, the city was able to retain a key institution, entice private developers to invest in infrastructure and buildings, and ultimately create an environment that has attracted entrepreneurs and established companies.

While the city allowed significant latitude in zoning, they did insist on ground-level retail throughout Mission Bay in an effort to create a good quality of life and ensure the neighborhood could compete with less expensive locations based partly on amenities and convenience.

University City faces a similar challenge in creating a value proposition for companies. As leaders focus on business development, they must continue to focus on strengthening the quality of place and amenities surrounding key business development areas in University City.

Seeing beyond biotech

While Mission Bay was designed to attract primarily biotech entrepreneurs and companies, the Bay Area is a hotbed of other innovation-based industries as well, and Mission Bay is positioned to accommodate these industries. In fact, Alexandria, the largest real estate developer in Mission Bay, is marketing and building flexible office space that can be used by high tech firms as well as biotech. More recently, Salesforce, a cloud computing company specializing in customer relationship management and other business-related applications, purchased 14 acres in Mission Bay to build a new office.

While the life sciences sector dominates the innovation-based economy in Greater Philadelphia and has great potential for growth, University City and regional stakeholders should be sure that new office development is appropriate for and attractive to other sectors (IT, media, etc.), and that outreach and marketing efforts are geared to these additional sectors as well.
Cambridge: Planning for Business Development and Technology Transfer

It’s tempting to look at Cambridge and simply see an innovation economy ecosystem that is on autopilot, spurred by a massive institution that has entrepreneurship encoded in its DNA and is loaded with venture capital. (And that’s without taking Harvard into account.) While there is no recreating the unique set of conditions that created Cambridge, it is worthwhile to look at some of the decisions and policies that made Cambridge the place it is today.

MIT and the Long View
Institutional and public policy decisions played a major role in laying the foundation for the development of biotech, IT, and other innovation-based sectors in Cambridge. Some of these decisions date back to the 1960s when MIT took an entrepreneurial and somewhat risky approach to developing its campus and investing in the city. These decisions led to the establishment of valuable office and lab space adjacent to MIT’s campus that has been crucial to the development of innovation-based clusters.

Cambridge was a manufacturing center for a rotating cast of industries – soap, rubber, paint, and chocolate among them. As the last of these industries left in the 1960s, the city struggled with a shrinking tax base and a glut of real estate.

In response, MIT began buying surrounding land, anticipating the need for more space in the future. Leadership also recognized the negative impact on the institution of being located in a failing city surrounded by abandoned land. Rather than buying the land and banking it or building campus facilities, they entered into long-term ground leases (60 years and longer) with private developers, with a vision of developing business centers marketed to private companies and professors needing nearby, off-campus space. MIT found a willing partner in the city, as leaders recognized the impact that the university could have on the community and the quality of life. The city and its Redevelopment Agency were partners in each of three major development projects that unfolded over several decades – Technology Square, Cambridge Center, and University Park. MIT cites these business centers as fundamental to changing the surrounding environment by creating major nodes of employment and tax revenue for the city and ultimately laying the foundation for a new economic climate in the area.

The Technology Square, Cambridge Center and University Park developments were complex, long-term projects that required dogged determination and persistence on the part of campus planners and university leadership. Beyond purchasing the land, MIT has also used a portion of its endowment to invest directly in these developments.

In the case of Technology Square, MIT’s efforts began in 1960 and the development wasn’t completed until 2001. This project was highly speculative and risky, but extremely successful in the end. The university invested $2 million of its then-valued $11 million endowment in the project. Remarkably, this project spanned (and survived) five different MIT administrations.

Cambridge Center was developed on the shortest time frame, over the course of ten years, and underscores the importance of building flexible space that can be tailored to different business needs.
Currently dominated by biotech companies, multiple sectors have cycled through the space since it was completed in the 1980s.

University Park is the only one of the three developments that includes residential units and retail space in addition to office and lab space. It was completed in 2005 and as with the other developments, is the result of a public-private partnership among MIT, the City of Cambridge, and a private developer.

These developments continue to be extremely successful, commanding some of the highest lease rates in the region - $50-$75 per square foot compared to $20-$40 along the Route 128 Corridor, a vibrant suburban commercial real estate market in its own right.

University Park notwithstanding, the development around MIT didn’t include plans for retail or housing. The singular focus on office space has resulted in a sterile nine-to-five environment with few amenities. One leader pointed out that a worker developing cutting edge drugs for a pharmaceutical company in Cambridge would be hard pressed to walk out of the lab and find a drug store to have a prescription filled.

MIT, the City of Cambridge, and the Kendall Square Association, a neighborhood business association, are working on this issue. There is no easy fix, however. MIT has a long history of, and financial success in, developing office space, and retail is less profitable and more risky. They have established one of the densest clusters of high-tech companies anywhere in the world, but to maintain that vibrancy, they will need to focus on quality-of-life improvements. MIT’s current leadership recognizes the need to develop these amenities, and late in 2010 held a series of public meetings to discuss potential retail plans for a number of its properties located near the Kendall Square public transit station.

**Making Tech Transfer Work**

Technology transfer is a cornerstone of a well-developed innovation economy. Cambridge provides an interesting and contrasting case study for technology transfer. First there is MIT, arguably the gold standard for tech transfer, a place where it seems to just happen naturally. A few miles away at Harvard, the research is just as impressive, but a different model has emerged, one that got a much later start than MIT and has taken deliberate actions to try and catch up.

MIT’s Technology Licensing Office (TLO) is among the most active in the US. It holds more than 1,500 patents and assists in the spinout of 20 to 30 companies each year. MIT’s focus on applied research and entrepreneurship goes back to its founder, William Barton Rogers, who envisioned an institution where students would “learn by doing” and one that would address the challenges created by advancing technology and science.

**MIT Technology Licensing Office**

The MIT TLO cites several important activities and approaches as responsible for their success:

- The office is staffed primarily by individuals with strong science backgrounds and experience in academia and industry. Staff members are self-driven and thrive in the complex and ambiguous environment of technology licensing.
- Staff is not incentivized based on number of patents processed or deal flow.
• University leadership fully supports the TLO mission, prioritizes entrepreneurship, and allows the office to operate relatively autonomously. The TLO makes final decisions in regards to pursuing patents and licensing agreements.

• The office plays a “virtual incubation” role to support the formation and growth of new companies. Generous financial terms early on and low royalties give companies time to become established and successfully commercialize technologies. The office can also introduce inventors to advisors who can help with strategies and business plans, as well as venture capital firms and angel investors to provide funding.

Beyond the TLO, MIT is home to a network of centers that support entrepreneurial endeavors of students and alumni, each of which operates independently and reports to a different department. These centers include the Deshpande Center (reports to the Engineering School), Enterprise Forum (reports to Alumni Relations), and Entrepreneurship Center (reports to the Business School), as well as dozens of student-run organizations. These centers and groups manage to work collaboratively in an environment described by leaders as “controlled chaos.”

**Harvard Technology Development Office**

Lacking the entrepreneurial history of MIT, Harvard has recently made significant changes to increase technology transfer at the university. In spite of ranking first in biotech research in a 2006 Milken study, Harvard ranked 18th in technology licensing, licensing income, and startup firm creation. Recognizing this issue prior to the study, in 2005 Harvard brought in a new leader, Isaac Kohlberg, and empowered him to completely restructure the technology transfer office, the first step of which was renaming it the Technology Development Office (TDO) to signify a larger conceptual vision than simply patenting and licensing technology.

Another significant change was the consolidation of the medical school’s and the school of arts and sciences’ technology transfer operations. The teaching hospitals affiliated with Harvard maintain their own technology transfer offices. However, the Massachusetts Association of Technology Transfer Offices (MATTO) has developed licensing and IP agreements that the hospitals and a number of regional universities (including MIT) use, which has made cross-institutional efforts much smoother.

The TDO staff was expanded with a focus on adding personnel with a background in science and business, including individuals with Ph.D.s and C-level executive experience. This staff was charged with increasing high-profile outreach internally to faculty and externally to industry. Driven by the knowledge that industry and investors think of MIT before Harvard, leaders focused on strengthening industry and venture capital relationships through face-to-face meetings as well as regular events highlighting research or featuring a keynote speaker. The office’s annual networking event draws around 1,000 people, and events are sometimes held in conjunction with the business school and alumni relations.

Technology transfer leadership at both universities was particularly adamant about having staff with specific, appropriate skills. A dynamic tech transfer environment requires staff members who take a

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creative rather than purely analytical approach to crafting deals and working with faculty and industry. Both TTOs focused on hiring professionals with significant, hands-on experience in technology-based startups and science rather than relying primarily on patent and IP lawyers, as is often the case.

Technology transfer leadership also had similar takes on measuring success and incentivizing staff and faculty around tech transfer. In both cases, these were not high priorities. They argued that revenue generation through licensing income, although a common benchmark, is not a good measure of success. This is because income may not be realized for years after a deal is made. Counting patents is also troublesome as it can encourage staff and professors to pursue patents that have little value. Instead, technology transfer is best seen as an extension of the larger institutional mission of having a positive impact on society by accelerating important technologies.

**Diversified Clusters**

By sector, the innovation-based economy in Cambridge is about half biotech and half other high-tech (IT, cleantech, and others). This is a strategic balance that protects Cambridge from the inevitable ups and downs of innovation economy cycles. Cambridge currently is home to more than 160 life science and technology related companies, including big names like Novartis, Wyeth, Microsoft, and Google.

To some degree, this diversification came about by chance, the result of having world-class programs across the spectrum of engineering and life sciences. Beyond this, the city and region seem to be able to re-make themselves when required by permanent and cyclical shifts in the economy and to take advantage of emerging opportunities. Consider that biotech, now the dominant innovation-based sector in Cambridge, did not even exist 15 years ago.

The Cambridge Innovation Center (CIC) embodies this flexibility. CIC is a 300,000 square foot flexible office facility that leases to growing high tech and life sciences companies. The center was established in 1999 when the managers of the space (which is MIT-owned) found themselves with large amounts of empty office space and no good prospects for filling it with large tenants.

Instead, they created a dynamic business model that provides space for companies working on a short time horizon. They are able to turn office space over in two days to meet the needs of new and existing tenants and offer rolling four-week leases. The current mix of tenants is 25% life sciences, 30% high tech, 10% energy/sustainability, and 35% service providers - communication firms, venture capital firms, and others looking to be close to the action.

**Cross-Institutional Collaboration**

MIT and Harvard as well as other significant research institutions, including the Draper Labs and a number of world-renowned hospitals across the river in Boston, have come together to create several collaborative research institutes in Cambridge. These institutes embody the recognition that innovation can be more effectively spurred through collaboration across disciplines and institutional strengths, and provide models for meaningful institutional collaboration.

The Broad Institute is one such collaborative effort. It is a genomic research center funded jointly by MIT and Harvard. Established in 2006, it is the first formal collaboration of its kind between MIT and Harvard. The Center for Integration of Medicine and Innovation Technology (CIMIT) includes a broader set of institutional partners including multiple area hospitals such as Massachusetts General Hospital and
Brigham and Women’s Hospital, MIT, Draper Labs, and Boston University, among others. The center brings together experts in translational research, medicine, science and engineering to rapidly improve patient care. The center also works with industry, foundations and government.

The Harvard Stem Cell Institute (HSCI), established in 2004, represents an effort to capitalize on the remarkable density of researchers working on basic, applied, and clinical research in the Cambridge/Boston area. The institute draws together the university’s resources – including the medical school and 11 affiliated teaching hospitals and research institutions – along with a host of additional hospitals and disease-specific research institutes (e.g. diabetes, cancer) to focus on stem cell research. Given the multitude of health issues that stand to be impacted by this research, as well as the ethical considerations around stem cells, cross-disciplinary expertise and engagement is required to facilitate success.

The business model, like CIMIT, is to accelerate technology through collaboration. No new lab space was created and the institute has been essentially virtual. The institute invests in three areas: seed grants, core platforms (such as shared equipment/facilities and production of specialized tools or substances), and specific disease programs. Funds totaling between $10 and $15 million annually come from faculty grants, sponsored research, and private philanthropy. HSCI partners with the university development office to raise private funds.

Activities include monthly day-long meetings focusing on research areas, special events around specific topics, “Chalk Talks” where scientists talk about their lab work (and are barred from using Powerpoint), and an annual retreat. HSCI provides limited funding for researchers, and faculty are drawn to the institute for the opportunities for collaboration and a chance to launch careers rather than for research funding. Seed grants are generally around $100,000, a fraction of the funding that faculty require. They are generally targeted to early-stage, risky projects not eligible for federal funding. When the HSCI board tracks the outcome of these seed grants, they are looking for a certain amount of failed endeavors. If the success rate is too high, it may mean they are not taking enough risks when selecting projects.

To date, research performed at HSCI has led to five startups, and the institute recently signed a $25 million sponsored research agreement with GlaxoSmithKline. Leaders cite the unique breadth of expertise of HSCI faculty as driving this pharmaceutical investment in the institute. And the numbers are impressive. HCSI has brought together 200 faculty and 900 scientists since its founding. The MATTO agreement, mentioned earlier, has played an important role in the smooth functioning of patent and commercialization opportunities that result from HSCI collaborative research. The need to be more nimble and flexible than large institutions are typically is also important. This requires some independence from institutional policies and procedures, which Harvard has allowed.

**Cambridge’s Keys to Success & Lessons for University City**

Cambridge provides a story of remarkable success driven by an entrepreneurial culture that is, in many ways, the result of a unique set of circumstances. Still, when each of those circumstances is viewed individually, they provide valuable insights toward building a successful center of innovation.

**Campus planning for economic impact**

MIT leadership invested significant resources in developing business centers around campus. Using long-term ground leases and working with government agencies and private developers, the institution
created millions of square feet of office and lab space for private companies interested in being near campus. More recently, MIT has begun to focus on developing retail and other amenities to improve quality of life in the area and ensure that it remains a desirable, competitive location for companies and their employees.

MIT is rather unusual among universities in having proactively developed business centers near campus. Universities, including those in University City, have typically focused on future institutional space needs and developing retail and amenities. For University City to develop a thriving innovation economy, institutions and other stakeholders will need to consider how to accommodate businesses’ office and lab space needs. This will include offering space with flexible and short-term leases that startups and growing companies require.

**Laying the foundation for multiple clusters to thrive**

MIT and Harvard have commanding research strengths across numerous disciplines that have helped in creating multiple industry clusters develop in Cambridge. The conscious development of flexible office and lab space that can be turned over quickly ensured that diverse companies could find appropriate space and lease terms.

University City institutions and other stakeholders should look for ways to nurture promising growth clusters in addition to the strong life sciences sector. Cross-institutional research partnerships and/or institutes could be created to support the development of these clusters.

**Getting technology transfer right**

Technology transfer is considered a core part of the institutional mission rather than a revenue generator for the institution. Both MIT and Harvard have worked to increase opportunities for cross-disciplinary and institutional collaborations to attract researchers and funding and more quickly bring discoveries to market. These tech transfer (or development) offices strive to hire creative problem-solvers who understand science and business, academia and industry. Staff members are not incentivized based on traditional technology transfer measures such as number of patents or licensing income.

In addition to modeling this approach to tech transfer in their tech transfer offices, University City institutions could build on models such as the Science Center’s Quorum and QED Proof-of-Concept funding programs to create a centralized commercialization and innovation center that showcases the research and technologies being developed at institutions in University City and across the entire region.
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