THE MARYLAND-NATIONAL CAPITAL
Park and Planning Commission

Research University Satellite Campuses
Case Study Analysis

Submitted to The Maryland-National Capital Park and Planning Commission
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A&M

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Appendices

1. Project Background

Economic competitiveness is one of the core themes of Thrive Montgomery 2050, the update to the General Plan currently being undertaken by the Montgomery County Planning Department. Several Montgomery County stakeholder groups, including elected officials, have expressed concern about the lack of a research university within the borders of Montgomery County because of the economic, educational, and social benefits afforded to communities that host similar institutions. During the FY20 budget work sessions, the County Council asked the Planning Department to study the possible role of a research university in the local economy, and whether it could increase entrepreneurship and business formation. This study provides a first step in addressing that question by examining what has driven university expansion in other places and the types of public and private investments were required to support the initiatives. The work was completed in close coordination with the Montgomery County Economic Development Corporation (MCEDC), which concurrently was also managing a separate consultant investigating the possibility of an expansion of the University of Maryland in Montgomery County.

Case Study Objectives

The Maryland-National Capital Park and Planning Commission (M-NCPPC) engaged the consultant team of Bolan Smart Associates and Alvarez & Marsal to identify and assess characteristics of research universities that have established satellite campuses. Employing a case study and lessons-learned methodology, the report emphasizes the roles of graduate and post-graduate education and faculty research, as opposed to undergraduate education. As part of this process, the consultant was tasked to explore salient factors impacting university commitments to facility and program growth at new campus locations. As the consulting team has experience working with communities and universities on economic and real estate development plans, the analysis is informed by their expertise and general understanding of economic development principles, institutional practices, academic research related to university-economy interactions, and possible relevance to Montgomery County. This experience includes engagements directly with many regional and national universities related to local community impacts.

Topics of consideration include:

- What dynamics have caused large research universities to open satellite campuses?
- How have institutions of interest navigated the process of realizing a campus commitment?
- What are the most common types of academic and research programs that are located away from home campus locations and how have they fared over time?
- Are there examples of land grant (state funded) universities that have expanded outside of their home-states?
- What efforts and tools have local governments undertaken to attract universities?
- How has/will technology impact off-campus research and technology transfer coming out of universities?
- Are there proximity related examples of significant university-federal collaboration?
- Are there examples of expanded universities partnering in a significant way with the local private sector in the new community?

2. Primary Observations

The case study analysis points to several key circumstances that contribute to successful university commitments, summarized below.

Overview of Case Study Characteristics

- Research universities need to be understood for their differences from other postsecondary institutions primarily focused on educational activities. While comprehensive research institutions offer courses to students, much of the status, reputation, and local economic contribution of a major research university comes from its research activities.

- The term “satellite campus” or “branch campuses” can take many forms, whether constituting a traditional university defined “place”; being a part of some other physical environment; or mostly being a functional concept (on-line classes, collaborative activity defined, etc.) that is only minimally anchored by an actual physical presence.

- With the possible exception of supplemental funding (public and/or private), all of the defining elements and variables summarized in the following University Opportunities section have to exist or be brought together in some fashion for successful results. That said, non-university directly sourced funding usually plays a fundamental role in leveraging university commitments, enabling third party funding to help mitigate other possible constraints, such as partnership limitations, locational challenges, infrastructure deficiencies, or building cost issues.

- The case study evaluation criteria developed for this analysis identified limited examples (especially with life sciences focii) that are directly comparable to Montgomery County. We state this at the outset because of its significance in setting the stage for seeking to interpret the study findings.

University Contexts for Determining Institutional Commitment to a Satellite Campus

Based on takeaways from all the case studies presented, reoccurring themes and common characteristics are summarized into five categories described as follows:

1. University Opportunities

The primary reasons for why a university would be interested in establishing a satellite campus include:

- Access to additional enrollment
- Access to faculty and research staff
- Enhancing graduate job placement
- Retaining talent in a target economic location
- Desire to attract research funding and contract resources
- Availability of funding support
- Opportunities to help seed entrepreneurial spinoffs and partnerships
- Desire to leverage alumni base, primarily for fundraising
- Advancement of brand and reputation
- Remaining competitive with other universities
- Locational limitations of existing main campus
- Proximity to different and or desired industry sectors
- Support of local economic development
- Extension of existing relationships and partnerships
- Establishing a physical presence and enhancing visibility

2. Core Mission and Management Needs

Research universities must maintain a robust job placement rate for graduates, attract premier faculty and adequate research funds, and maintain a strong brand. Satellite campuses serve as a vehicle to address these goals in manners that are not fully met by the main campus. The satellite needs to complement and reinforce the main campus, and possibly also fill gaps in pedagogy, programs offerings, or research capabilities. Success of satellite campuses are determined by University policy and administrative factors such as:

- *Geographic Range:* While both state-funded and private universities have expanded their physical footprints in recent years, private institutions appear to be less constrained with regard to where these expansions can happen. The rarity of state-funded universities establishing a physical footprint *outside* of their home state—Arizona State University's Global Campus expanding to Los Angeles being the lone example in this report—suggests that state universities are subject to legislative, institutional, or political constraints that limit their expansions to in-state locations, while private universities are more freely able to seek expansions in other states. Wherever these expansions happen—in-state or out-of-state—there must be a compelling reason for this large investment of resources, such as access to a key government or industry partner.

- *Independent Identity*: While a satellite campus will institutionally be tied to its main campus, it should have a distinct local identity and profile to fully take advantage of its local presence and impact the community. Campus functions that partially duplicate offerings at other locations may be viable, but the strongest examples feature unique curriculum offerings and research attributes. Measures that reinforce campus identity include having differentiated physical characteristics and even distinctive institutional name branding.

- *Phased Growth and Programmatic Evolution*: Like all large, long-term institutions, research universities and their satellite campuses confront change over time. While this is obvious, it is valuable to keep in mind when considering how a university presence can progress. To start, the consultant team notes that there is an inception period followed by initial implementation. This stage of investment is predicated on an investment payback period usually extending a minimum of 20 years. This investment horizon is subject to periodic checkpoints and reassessments. It is rare for all projected futures to fall into place without some strategic changes or programmatic pivots. Student market conditions evolve, industry training needs change, funding sources and partnership interests adjust, leaderships turn over, and competing policy objectives arise. Two fundamental systemic shifts seen over the last two decades include: 1) a refocus on more urban environments; and 2) the disruptive impacts of technological change. Technology, in particular, has dramatically affected university instruction and research portfolios. Amidst this change and evolution, universities will first ensure the preservation of their main campus priorities and satellite campuses may receive less attention/resources.

- *Physical Presence:* Recently, the role of bricks-and-mortar satellite campus facilities has been called into question, because the need for traditional classroom space has been declining. However, the need for specialized lab, support, and student gathering space continues. Additionally, there is a strong case that social contact is vital to conducting impactful research and fostering innovativeness. Satellite campuses' purpose to extend university visibility underscores the key role of having a physical presence. Of special interest to establishing new satellite facilities is the opportunity to accommodate and build for new educational and research formats, including participation in non-traditional partnerships, consortiums, and colocation that afford some level of collaborative cross-industry interface.

3. Linkages with Local Economy

The establishment and growth of the strongest performing satellite campuses are linked to the economic strengths of the markets in which they locate. In this respect, proximity to major corporations or public agencies drives site selection. Curriculum can be linked to a campus's research institutes or collaboratives, to feed specialized workers into employment opportunities with the institution's strategic partners. Growing enterprises attempting to build on primary research will strategically locate near geographic concentrations of research activity, which concurrently attract high-level faculty and students. Having a satellite campus can position a university not only to market its already well-established academic programs, but also to be at the

forefront of emerging industries. In some cases, the satellite institutions can grow from being dependent on market conditions to becoming a driver of regional economy and employment. There are also limits to the benefits of being near such research clusters. Despite the intrinsic merits of industry and research alignments, research information transfer is highly regulated and controlled. Federal institutions at all levels are subject to intensive information sharing scrutiny. Similarly, large and small private corporations are protective of their research-based capabilities. As a result, there are structural barriers that can defy the seeming physical, intellectual and systems application benefits that represent the critical information exchange assumptions upon which satellite facilities are premised.

4. Partnerships / Facilitators

As described in the case studies, partnerships are critical components of the establishment and sustainability of satellite campuses. Partnerships can involve shared facilities, resources, or intellectual property. Even the most financially endowed (mostly private) institutions seek partnerships to anchor and help fund their commitments. Partnerships can generate cost savings and efficiencies through both physical shared laboratory or classroom space, parking, etc. as well as mission-based objectives such as joint course offerings. In addition, satellite campuses with proximity to corporate or Federal partners enable broader research consortia with other universities. However, it should be noted that demand by potential partners for the presence of a prominent research university likely exceeds the supply of interested and capable institutions.

- *Public Investments:* There is no single or common model for investing in a satellite campus. Funding models depend on the organization's legal structure and financial stability, as well as revenue generation opportunities at the new campus. In some cases, the public sector can play an important role to champion the creation of a new campus or use creative financing tools to support development. The municipal tool set includes nurturing organizational infrastructure and partnerships, political and legislative support, legal frameworks, marketing, networking with formal feeder institutions, providing land, buildings and physical infrastructure, and providing discretionary capital (grants, bonds, other investment securities, favorable tax treatment, long-term sustenance, spin-off platforms, etc.).

- *Private Contributions:* Consistent with all larger university campaigns, contributions from alumni, wealthy individuals, corporations and charitable entities typically play the most significant role in making a new campus happen. These gifts are usually motivated by a geographic or industry focus of the benefactor and tend to be program or condition specific. There is strong evidence of the benefits of leveraging funding offers, involving matching grants, timelines and other performance factors.

5. Background Infrastructure / Environment

Investing in a new campus is an uncertain undertaking for universities, as well as its potential partners. Leveraging existing infrastructure, whether physical or social, can mitigate some of the capital and operating cost risks of developing a facility or program. Though not systematically measured in this study, demand for new research and instructional facilities is shifting away from

the suburban "office park" model and towards existing easily accessed locations and dense built environments that can appeal to the broadest spectrum of staff, students and partners. Finally, while the surrounding community, built environment, and compensation are important factors for faculty recruitment, high-level researchers are primarily motivated by the presence of world-class research facilities and colleagues may be the most compelling factor.

3. Scope and Limitations of Study

As outlined in Section 4, **Case Study Methodology,** the consultant, Montgomery Planning, and MCEDC staff collaborated on creating case study identification criteria and specifying target examples to profile. The case studies were not intended to be directly compared to or aligned with existing conditions in the County but may point to issues and topics for further consideration. Using this methodology, the consultant team and County selected four primary, five secondary, and six other case studies.

This limited exploratory study of satellite campus attributes has been conducted with the understanding that case study examples and readily available information cannot provide in depth insights into all questions. While the consultant is expected to perform thorough analysis and use sound judgment in its research and analysis, it is also recognized universities and university partnerships are inherently complex and not entirely transparent regarding their investments and decision making.

4. Montgomery County Context

Montgomery County has two public postsecondary education assets: Montgomery College and the Universities and Shady Grove (USG). These institutions cultivate homegrown talent by educating and training local students. It has also had a satellite campus of Johns Hopkins University since 1986. This section provides a brief overview of Montgomery College and USG followed by a brief history of Johns Hopkins University's presence in the County.

Montgomery College

Montgomery College is a community college offering associates degrees and certificates at three campus locations (Germantown, Rockville, and Takoma Park/Silver Spring), as well as online. In the fall of 2018, 21,720 students were enrolled for course credit. Most students (65.1%) attended on a part-time basis. Montgomery College students also tend to be older than students at four-year undergraduate institutions: 55% of students were 21 years of age or older in 2018, and 18% were over 29. The College granted 5,117 associates degrees in 2018. About half of these degree-earners transferred to other institutions, to complete their degrees. Montgomery College is an important feeder school for USG (see below).

Montgomery College's vision, as it relates to economic development, is to ensure that "the needs of all local employers are met and learners of all ages are prepared to compete in the economy."[1] Thus, it serves dual and complementary economic development purposes—to enable success and economic mobility of students, and to provide a quality workforce with skills demanded by employers.

Most of Montgomery College's credit students are enrolled in programs with the ultimate intent of transferring to a bachelor's degree program, often at USG. However, almost 6,500 students, or

30% of credit-seeking students in the fall of 2018 were enrolled in career or pre-medical/health programs. Of these, health and medicine programs including medical sonography, health information management, nursing, and surgical technology are the most popular. Business technologies, such as hospitality management, accounting, and conference and event planning are the second most popular career programs. The College also trains emergency responders, building and landscape tradespeople, and auto repair technicians.[2]

Montgomery College has three campuses: Takoma Park/Silver Spring, Rockville, and Germantown. Established in 1950, the Takoma Park/Silver Spring Campus is the oldest and the most urban of the three. Situated about halfway between downtown Silver Spring and Takoma Park and nearly abutting the Washington, D.C. border, this campus is well served by bus lines and Metrorail. However, some of its aging buildings are becoming obsolete and in need of replacement or renovation. The Rockville Campus is the largest of the three by student enrollment. It is in a suburban setting, about a mile from downtown Rockville, and accessible by several bus lines. The 228-acre, suburban Germantown campus is the newest of the three campuses and has expanded in size significantly since it opened in 1975.

A total of over 466,000 new square feet are planned across all three campuses through a combination of renovation and new construction, according to the 2016 Facilities Master Plan. This work is projected to cost approximately $722 million.[3] One notable recently completed project is the Pinkney Innovation Complex for Science and Technology (PIC-MC) at the Germantown Campus. This site includes the new Bioscience Education Center, Holy Cross Germantown Hospital, a LEED Silver medical office building, and the Germantown Innovation Center, which is a life sciences business incubator. PIC-MC also has additional acreage available for development to life sciences and technology companies.[4] Part of the intent of PIC-MC is to encourage "private companies…to provide opportunities for…students and to create a talent pipeline for the business."[5] The Germantown Campus is both a Regional Institution Strategic Enterprise (RISE) zone and an Opportunity Zone. These are state and Federal programs, respectively, that incentivize private development.[6] Approximately 55% of Montgomery College's total operating revenue (over $264 million) comes from Montgomery County, with tuition and fees (29%) and aid from the State of Maryland (14%) providing the second and third largest revenue sources, respectively, in fiscal year 2020.[7]

While Montgomery College is a major asset to the County by providing high quality training in local services and support activities like healthcare and the construction and automotive trades, and more recently by strengthening efforts to provide a pipeline for entry-level laboratory science occupations through the PIC-MC, it does not produce Master's- or PhD-level researchers who are also necessary for the sustainability and expansion of the County's biotechnology and other high-tech industries. This is the type of training that a major research university would supply.

Universities at Shady Grove

The Universities at Shady Grove (USG) is a unique model of postsecondary education delivery, offering undergraduate and graduate degrees from nine of Maryland's public universities[8] on one campus. Students receive degrees from the university that administers their program, but they take classes and earn credit towards this degree at the USG campus. For example, a USG student earning a Bachelor of Science degree in Biological Sciences would receive a University of Maryland-College Park (UMCP) degree but would have physically attended USG. USG undergraduate programs accept applications from students who have taken at least 60 undergraduate credits (often from places like Montgomery College). Of the institutions represented at USG, UMCP confers the largest percentage of undergraduate degrees (33% in 2019), while University of Maryland-Baltimore (UMB) confers the largest percentage of graduate degrees (38% in 2019).[8] Since its establishment in 2000, 12,000 students have earned degrees from USG.[9]

In the fall of 2019, 1,991 undergraduate students and 1,044 graduate students were enrolled at USG. Like Montgomery College, undergraduates at USG tend to be slightly older than undergraduates at traditional public universities. For example, the average age of USG daytime undergraduate students in the fall of 2019 was 26 years[10], while at the University of Maryland-College Park the average age for these students was 20.5 years.[11]

USG offers graduate degrees in several community-serving fields like Public Administration, Education, and Social Work. It also offers graduate degrees in high-tech and business fields, such as Pharmacy, Biotechnology, and Cyber Security, as well as a Master of Business Administration (MBA). Its new Master of Professional Studies (M.P.S.) program in Biotechnology is "a new kind of degree designed to prepare science professionals to fill management and leadership roles in biotechnology-related companies or agencies,"[12] and can provide an important set of skills and talent infusion to the region's biotechnology industry. USG also has a similar program in Cyber Security, with both degrees administered by University of Maryland-Baltimore County. However, with these programs ramping up, enrollment remains small relative to the large presence of these industries in the area. For example, there were 55 students in the M.P.S. in Cyber Security program in 2018, which increased to 63 in 2019.[13] Also, PhDs generally drive research, and USG does not currently offer any PhD programs in scientific research.

USG recently opened the 220,000 square-foot Biomedical Sciences and Engineering Education Facility to house "high demand programs in healthcare, biosciences, engineering, and computational science disciplines."[14] The University of Maryland's Institute for Bioscience and Biotechnology Research (IBBR), aimed at commercializing basic life science research, is located

[8] These include Bowie State University, Salisbury University, Towson University, University of Baltimore, University of Maryland-Baltimore, University of Maryland-Baltimore County, University of Maryland-College Park, University of Maryland-Eastern Shore, and University of Maryland-Global Campus.

on the USG campus The IBBR houses researchers from University of Maryland-College Park, University of Maryland-Baltimore, and the National Institute of Standards and Technology (NIST). Research at the IBBR spans many disciplines, including Cell Biology and Molecular Genetics, Plant Sciences and Landscape Architecture, Microbiology and Immunology, and Biosystems and Biomaterials. IBBR researchers also frequently partner with private industry.[15]

Johns Hopkins University

History

The campus origins trace to 1983 and a series of conferences sponsored by the Montgomery County Commission on Higher Education in Science and Technology. The Commission, which included faculty and administrators from Johns Hopkins University (JHU), concluded that a major research university was critical for the area's future economic development. In 1984, Johns Hopkins conducted its own feasibility study that pointed to a high level of interest in graduate courses and noncredit programs in computer science, electrical engineering, public health and technical management.

Then Montgomery County Executive Charles Gilchrist and JHU President Steven Muller, who also served on the Montgomery County Commission on Higher Education in Science and Technology, collaborated to spearhead an agreement whereby Montgomery County contributed 36 acres of land, public improvements and $9.0+ million to start a campus. As a key part of a cooperative effort to anchor a new research campus at the Shady Grove Life Sciences Center, the agreement stipulated the university would offer graduate and noncredit programs targeting students and businesses in what was then described as the I-270 biotechnology and information technology corridor. A potential for 2.7 million square feet of office, education and lab space was projected at build out.

The university broke ground on the campus in 1986 and opened as the JHU Montgomery County Center in fall 1988 in a new 49,000-square-foot building (later named Gilchrist Hall). A second 49,000-square-foot building opened in 2000, known as the Academic and Research Building. In summer 2004, another 115,000-square-foot was added (Building III), which included space to be leased to non-JHU tenants — primarily science and technology-related companies, agencies or organizations. As of 2004 the MCC totaled 215,000 square feet of building area, comprised of 40 classrooms, a wet lab, computer labs, library, auditorium, presentation room, support and office space.

Through 2010, enrollment ranged upward of 4,500 to 5,000 students, representing a mix of full and part-time continuing education enrollment. The curriculum encompassed more than 60 degree and certificate programs from five university divisions: Arts and Sciences, Business, Education, Engineering and Public Health involving roughly 450 adjunct and full-time faculty and dozens of lab-oriented researchers. Part of the core identity of the campus was the Center for Biotechnology Education, focused on graduate training and the work environment in the fields of biotechnology, bioinformatics, regulatory science, and biotechnology enterprise and

entrepreneurship. Over the years, the campus was also becoming home to an increasing number of corporate, nonprofit and research tenants, a purposeful goal of both JHU and the County.

Conceptual Origin

The merger of interests between JHU and Montgomery County coalesced around Hopkins desire to expand upon its historic Baltimore-based, nationally prominent research capabilities and the County's projected growth in modern science research-based industry. Both entities foresaw strong synergistic opportunities that could be advanced by bringing together land and infrastructure investments (Montgomery County) and construction and operating capital (JHU). Prominent background economic conditions at the time were emergent breakthroughs regarding commercially viable scientific discoveries, most notably under the umbrella category of "life sciences".

Evolving Circumstances

While inspired by foundational expectations of the "life sciences" model, 15 years later the sciences and technology industry in Montgomery County had achieved only part of its projected growth. For Hopkins, this was not initially a critical factor in developing its educational presence, with facility use for a period supported by the inclusion of a range of non-science related instructional programs. University efforts continued in cultivating industry inspired partnerships, leveraging Hopkins resources in pairing together research expertise with entrepreneurship interest. Related, but for different purposes, Hopkins land development (and income potential) was able to be directed toward partnering to attract new third-party users, the largest example being a ground lease for NCI's 575,000 sf campus in 2010. (Note that JHU's development of the property was subject to covenants included in the original conveyance from Montgomery County.)

Coinciding with the somewhat slower than projected science industry growth, from its foothold in the Washington DC region, Hopkins continued to pursue other opportunities to expand alternate educational programs. During this period, enrollment growth for non-science related disciplines was channeled through more central locations in downtown Washington, a strategy that was geographically more connected with the related subject matter focuses and found to be more accessible to a broader student population. Further impacting traditional classroom functions during this time technology was a rapidly transitioning to hosting online courses, reducing the need for conventional educational spaces, particularly for continuing education type functions. Additionally, extraordinary long-term funding support for JHU's Applied Physics Laboratory in Laurel, MD – the nation's largest university affiliated research center – continued to propel growth at this large and this highly diversified nearby campus. Nearby in Columbia, MD, JHU maintains a small academic presence. Ultimately, after 20 years of program development in Montgomery County (circa 2009) JHU leadership found itself redoubling its focus and resources on its core-oriented Baltimore legacy and asset base.

Short of adding more capacity at Shady Grove, after the completion of its third MCC building JHU began a gradual process of regional program consolidation. In 2018 the MCC library at Gilchrist Hall was shut, and ultimately in fall 2019 the University formally announced that it is closing its core academic graduate programs by the summer of 2020. For the 275 remaining students that

attended classes at the Rockville campus as of Fall 2019, four of the remaining six master's degrees offered are available entirely online, and the same programming is offered in Baltimore at the university's main campus. For now, the university will retain the Montgomery County location of a limited senior education program, known as the Osher Lifelong Learning Institute.

As of late 2019 Hopkins has not indicated publicly its intent for the possible future of the remaining educational components of its campus. It continues to partner with and seek out new research related economic ventures keyed to the Montgomery County marketplace, as well as steward its other real estate investments / endowments., including the proximate 108-acre Johns Hopkins Belward Research Campus. The greater university entity also remains heavily invested in local medical services, including its 2009 merger with Suburban Hospital in Bethesda.

5. Case Study Methodology and Approach

Selection Process

Montgomery County can learn important lessons from assessing existing research universities nationally and worldwide to identify the specific conditions that prompted and enabled their satellite facility expansions.

An initial list of over 60 research universities was identified based on a review of: a) the largest recipients of funding from the National Institutes of Health (NIH); b) the largest research and development expenditures as identified by the National Science Foundation; c) The Best Colleges Top 10 Satellite Campuses; and, d) recommendations from Montgomery County's project team. See Appendix A for the universal list.

This list of candidate case studies was reduced to 22 institutions based on a set of initial evaluation criteria and in collaboration with the County, including:

- Established satellite campus
- Graduate-level curriculum offered
- Satellite located in major metropolitan area with suburbs
- Recognized/Renowned research and development institution
- Presence of partnerships or incubators on campus

This list was further reduced to nine institutions based on additional evaluation criteria in collaboration with the County, including:

- Types of partnerships (including Federal agencies), research opportunities, and incubator / accelerator programs
- Campuses that are not exclusively instructional (i.e. included a research component)
- Multimillion-dollar initial investment and ongoing operational commitment
- Campuses that are not exclusively bricks and mortar

- Campus located in an economy with industry parallels to life sciences

Selected Examples

Of the nine-candidate list universities, four were selected as the primary case studies that were evaluated and presented in alphabetical order:

- Chapter #5: Case Study #1 - Carnegie Mellon University in Mountain View, California
- Chapter #6: Case Study #2 - Indiana University–Purdue University in Indianapolis, Indiana
- Chapter #7: Case Study #3 - Texas Medical Center in Houston, Texas
- Chapter #8: Case Study #4 - Virginia Tech in Arlington, Virginia

Another five less comprehensive secondary examples provide more insight into the variables involved. All of these secondary case studies are presented in Chapter 9 as follows:

- Arizona State Polytechnic University in Mesa, Arizona
- University of Arizona Tech Park at The Bridges in Tucson, Arizona
- Cornell Tech in New York City, New York
- University of Michigan in Detroit, Michigan
- Scripps Research Institute in Jupiter, Florida

Since the initial pool of candidate case studies was extensive, six additional examples are referenced in Chapter 9 as other examples to illustrate important takeaways:

- University of Chicago Booth School of Business in London and Hong Kong
- Colorado State Global Campus in Fort Collins, Colorado
- George Mason University in Prince William County, Virginia
- Georgia Institute of Technology in Savannah, Georgia
- New York University in Shanghai, China
- University of Southern California at Institute of Science Innovation in Marina del Rey, California

Presentation Format

Each of the four primary case studies are analyzed and organized into the following sections:

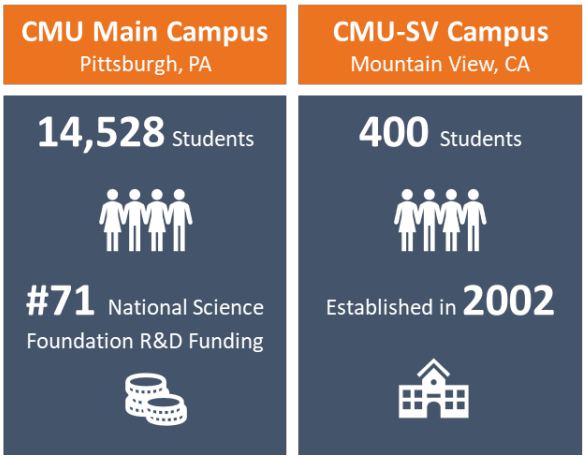
- *Background Context:* Provides orientation and baseline campus data for both the main and satellite campuses in addition to satellite location demographics.
- *Drivers for Additional Campus:* Describes reasons and motivations for opening a satellite facility.
- *Process and Administration:* Focuses on implementation, noting how the university selected the site / location and established program / facility oversight.
- *Investment:* Explains how the satellite facility was funded, if available, including public sector resources.

- *Curriculum:* Details specific graduate level program concentrations.
- *Industries:* Identifies prominent local market industries proximate to the satellite campus to ascertain if academic and economic linkages exist.
- *Partnerships:* Documents the role of corporate and federal partnerships for research universities, especially when instrumental in establishing new satellite facilities.
- *Campus:* Presents basic features regarding the physical aspects of the satellite facility.
- *Notable Features and Takeaways:* Captures important observations and lessons learned.

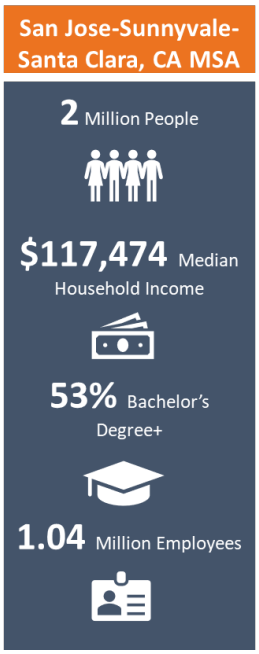
Treatment of the five secondary case studies scale back the level of details and include only four of the organizational sections used for the primary case studies: Background Context, Investment, Partnership, and Notable Features and Takeaways. The remaining six case studies were further refined to provide Background Context and Notable Features and Takeaways.

6. Case Study #1: Carnegie Mellon University at Mountain View, CA

Background Context



Carnegie Mellon University (CMU) is a private, global research institution founded in 1900 in Pittsburgh, Pennsylvania and ranked #25 in the *U.S. News & World Report* rankings of National Universities. The main campus is home to seven colleges and is renowned for the strength of its research and engineering. CMU's computer science, computer engineering, artificial intelligence, and information and technology management programs are all ranked first in the country.[16]



Outside of Pittsburgh, CMU has established satellite campuses in Silicon Valley, CA and Qatar, as well as programs in Africa, Asia, Australia, Europe, and Mexico.

CMU sought to develop a presence in Silicon Valley in 1999 to conduct research with the National Aeronautics and Space Administration (NASA) and technology companies; establish educational programs; offer special internship and work opportunities to students on the Pittsburgh campus; and develop closer ties with the nearly 3,000 alumni who live and work in Silicon Valley. It established the West Coast campus – now referred to as Carnegie Mellon University Silicon Valley (CMU-SV) – in 2001 in Building 17 on Moffett Field by NASA's Ames Research Center. CMU-SV opened for classes in September 2002 with 56 students enrolled in two programs leading to a Master of Science degree in information technology. The course of study was built around hands-on, project-oriented, apprenticeship-based, and individually mentored activities that emphasize teamwork and collaboration.[17,18] Since inception, there are an estimated 600 alumni and annual enrollment has grown to approximately 350 students.

Drivers for Additional Campus

Desire for West Coast Presence

Given the strength of CMU's computer science and engineering programs, CMU was eager to establish a presence in Silicon Valley. A West Coast campus allows CMU to strengthen its research relationship with NASA, partner with technology companies based in Silicon Valley, offer

research and job opportunities to students on the main campus, and bolster connections with alumni in the region.

Established Partnership with NASA
CMU had a strong research relationship with NASA, which was further reinforced after CMU reached a $23.3 million agreement with NASA to focus on high dependability computing and lead a research consortium of five universities.[19]

Available Space at NASA Research Park
NASA leveraged its enhanced use lease authority to establish the NASA Research Park at Moffett Field. This provided an opportunity for CMU to sign a long-term lease and collocate with a major research partner, along with other technology companies and higher education institutions.

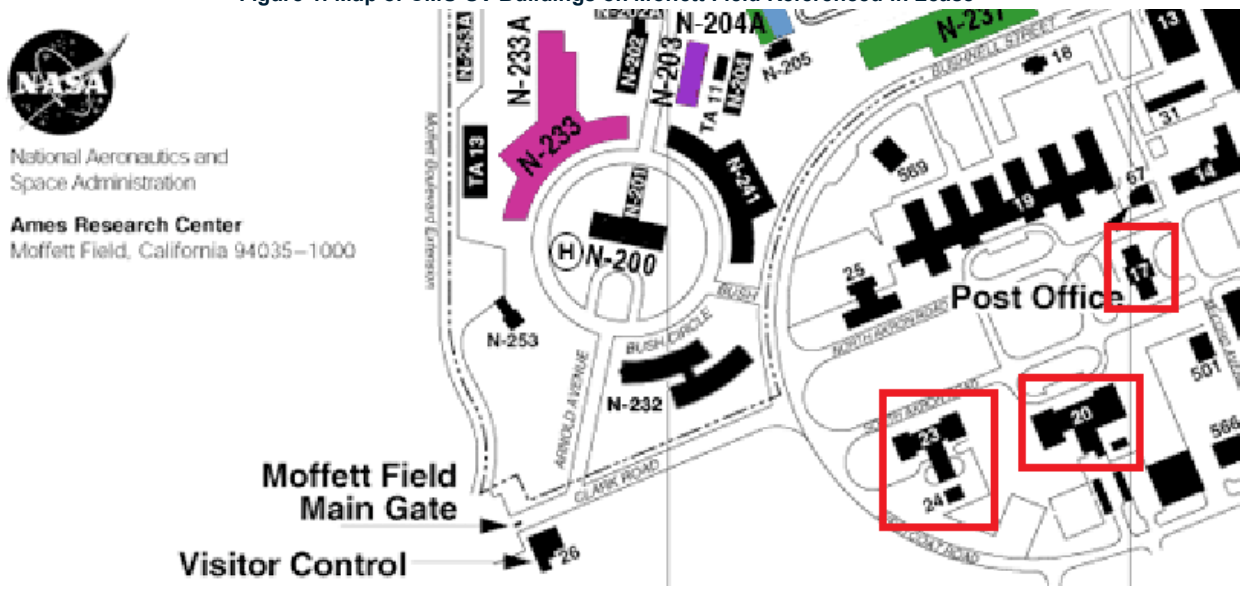
Process and Administration

Carnegie Mellon describes its vision[20] to establish the Silicon Valley campus as intended to:

- Extend CMU's brand to Silicon Valley
- Create new opportunities for students and faculty from Pittsburgh in the CMU-SV region
- Offer programs that leverage the CMU-SV ecosystem
- Become a conduit for entrepreneurial activities for students and faculty

After signing an initial lease in 2001 in Building 17 at Moffett Field, CMU signed a long-term lease with NASA in 2003 under which the university committed to renovating 19,000 square feet of space for its growing Silicon Valley campus in Buildings 23 and 24 on the historic Shenandoah Plaza. Under the terms of the agreement, CMU may lease the buildings for 15 years and exercise additional options to extend the term of the lease up to 48 years. CMU also has the right of first refusal to lease Buildings 17 and 20 on the six-building quadrangle.[21]

Figure 1: Map of CMU-SV Buildings on Moffett Field Referenced in Lease[22]



CMU-SV is administered by Steven Rosenberg, who serves as Senior Director of Operations. The campus is home to 15 core faculty and eight researchers. Since some of the programs offered are bicoastal between the Pittsburgh and Silicon Valley campuses, five professors from the Pittsburgh campus also teach courses associated with CMU-SV programs.[23]

Investment

While it is not apparent how CMU is currently funding its satellite campus, the institution did receive significant philanthropic support from well-known technology leaders and entrepreneurs to establish the campus.

There is also information that details CMU-SV's annual rent at Moffett Field. According to an audit of NASA's historic property conducted by its Office of Inspector General, NASA bases the rent at Moffett Field on periodic appraisals to determine the fair market value and adjusts for inflation. While the base rent as of the OIG's 2018 report was $354,048 per year, CMU-SV can earn rent credits based on the cost of capital improvements made to the facility. CMU-SV has earned approximately $5.6 million in rent credits. In addition to base rent, CMU-SV pays annual institutional support costs for security and infrastructure maintenance and reimburses NASA for services provided like utilities and maintenance. The annual support costs in fiscal year 2018 totaled $101,986.[24]

Curriculum

CMU-SV offers only graduate-level degree programs across its three departments: Electrical and Computer Engineering, the Information Networking Institute, and the Integrated Innovation Institute. The campus has already graduated over 700 master's and Ph.D. students. Current degree programs align directly with the economic strengths of Silicon Valley, including:

- M.S. in Software Engineering
- M.S. in Electrical and Computer Engineering
- M.S. in Software Management (full time and part time)
- M.S. in Information Technology
  - Mobility (MSIT-MOB)
  - Information Security (MSIT-IS)
  - Software Management (MSIT-SM)
- Ph.D. in Electrical and Computer Engineering

Research & Research Centers[25]

Students attending CMU-SV receive a mix of technical, business, and organizational skills in each graduate program. They have the opportunity to support cutting edge research in partnership with tech companies and government agencies as they pursue their degrees. This is particularly true of electrical and computer engineering students, given the opportunities available through the CyLab Mobility Research Center detailed below.

- CyLab Mobility Research Center: Focuses on the opportunities, risks, and deep systems challenges associated with wireless connectivity – from small sensor devices and mobile phones to autonomous vehicles. Current research areas include Resilient Networking, Sensor Platforms, and Next-Generation Network Architecture.
    - Resilient Networking
        - Survivable Social Network: Developing a social networking system that can be deployed during a disaster that relays information without dependence on public telecommunications or internet infrastructures.
        - Disaster Management Initiative: Studying the use of information technologies to coordinate disaster management across jurisdictional boundaries with first responders, citizens, government, and industry.
- Integrated Symbolic Execution for Space - Time Analysis of Code: Aims to build an integrated approach that provides both qualitative and quantitative reasoning for space-time analysis of Java programs.
- Mobile, Embedded, & Wireless Security Group: Focuses on security and privacy in wireless communications, networking, computing, control, and data management. Topics of interest include designing reliable networking protocols for intelligent mobile devices and cyber-physical systems; secure computing and data management in sensing systems and the Internet of Things; robust wireless communication protocols; and developing secure services for smartphones and other mobile platforms.

Industries[26]

The curriculum and research at CMU-SV are directly aligned with the economic strengths and opportunities in the region. CMU-SV is located in the San Jose-Sunnyvale-Santa Clara, CA MSA, which houses some of the world's largest technology companies including Adobe, Cisco Systems, eBay, HP, Intel, Fujitsu, and Lockheed Martin Space Systems.[27,28] This is supported by Figure 2 which classifies the largest industries as Professional, Scientific, & Technical Services; Manufacturing; and Health Care & Social Assistance.

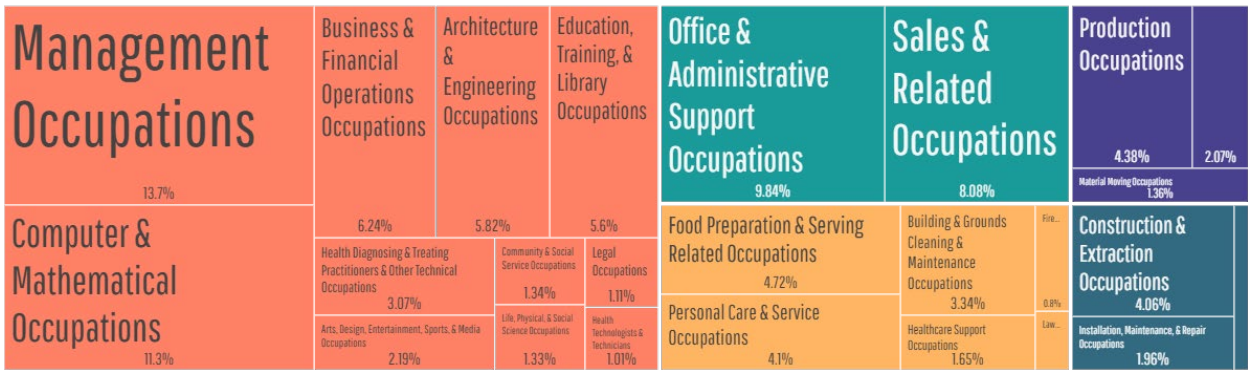
Figure 2: Employment by Industries in San Jose-Sunnyvale-Santa Clara, CA MSA

Total: 1.04M

This MSA employs 1.04 million people, many of whom work in management or computer and mathematical functions, as indicated in Figure 3. Given that the region's largest employers[29] include firms like Apple and Alphabet, it is clear why CMU-SV's academic and research focus in the areas of computer science and engineering are congruent to the job opportunities prevalent in Silicon Valley.

Figure 3: Employment by Occupations in San Jose-Sunnyvale-Santa Clara, CA MSA

Total: 1.04M



Partnerships

The establishment of a satellite campus in Silicon Valley fortified CMU's existing research partnerships with federal agencies like NASA and formed new ones given its reputation as a world-renowned computer and engineering research institution.

NASA

CMU has had a long, significant research relationship with *NASA's Ames Research Center*. Researchers from both organizations have collaborated to develop high-profile robots such as Dante, which explored the interior of a volcano, and Nomad, which discovered meteorites in Antarctica. In addition, CMU researchers from a diverse array of departments have worked with NASA Ames researchers on projects including formal methods for verifying digital circuitry, vision and navigation, machine learning, and data mining.[30]

NASA and CMU formed the High-Dependability Computing Consortium (HDCC) with 15 Silicon Valley companies focused on reducing failures in computing systems critical to the welfare of society. In January 2002, CMU received $23.3 million from NASA to develop a multi-disciplinary, multi-institutional High-Dependability Computing Program to improve NASA's capability to create dependable software. The incremental five-year cooperative agreement is part of a broad strategy for dependable computing that links NASA, CMU, corporate partners, and other universities. CMU experts will collaborate with NASA scientists and researchers from other universities to measure and improve the dependability of NASA's systems. The other university partners include Massachusetts Institute of Technology, University of Maryland, University of Southern California, University of Washington, and University of Wisconsin.

In May 2002, NASA announced the formation of the Sustainable Computing Consortium, a groundbreaking collaborative designed to protect the nation's computing infrastructure and improve the reliability of its information technology systems. This coalition of leading global businesses, world-class software developers, and federal agencies is led by CMU.[31]

Corporate

In November 2015, *Emirates Group* founded the CMU-Emirates Silicon Valley Innovation Lab to support educational activities that connect Emirates Airline and *dnata*, one of the world's largest air service providers, to leading-edge technology and innovation capability from CMU and the larger Silicon Valley ecosystem. CMU uses the Innovation Lab for courses on entrepreneurship, enterprise innovation and commercializing intellectual property, as well as other curriculum-based projects, support of startups through a pre-accelerator and hack-a-thons, in an effort to take key business challenges and leverage data, analytics and advanced technology to create a world-class Emirates customer experience.[32]

Other Partnerships

CMU-SV has undertaken other research partnerships with federal government agencies. For example, CMU-SV partnered with the *U.S. Geological Survey*, NASA's Jet Propulsion Laboratory, California Institute of Technology, and the University of Houston to publish a report in April 2015 on how to utilize smartphone data as an early warning system for large earthquakes, particularly in areas that lack expensive conventional systems.[33] CMU-SV also received a grant from the *Department of Homeland Security* to investigate how wireless technology can be improved to generate more informative emergency alerts, the findings of which they published in a December 2015 report.[34]

Figure 4: CMU-SV Partnerships

Campus

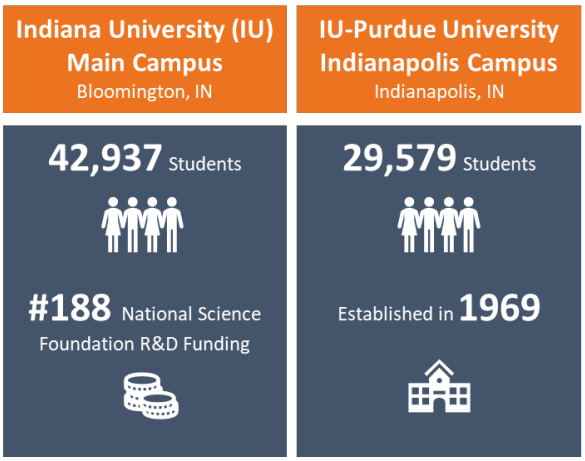
CMU was able to realize its vision of a West Coast presence after NASA leveraged its Enhanced Use Leasing Authority to develop the NASA Research Park (NRP). This allowed NASA to execute leases of existing building space to technology start-ups and universities. Major universities that have located in the NRP include CMU, University of California, Santa Clara University, Singularity University, Taksha University, and others that operate classes and research and development programs onsite. NASA executed two large separate ground leases for new construction with Planetary Ventures LLC – a subsidiary of Alphabet – and University Associates LLC – part of the University of California System. Planetary Ventures is building 1.2 million square feet of research and development office facilities on 42 acres. University Associates is building 3 million square feet of research and development labs, classrooms, and onsite housing on 77 acres. Non-profits that operate programs onsite include the Unmanned Aerial Vehicle (UAV) Collaborative, the Mars Institute, and the Kentucky Science and Technology Institute.[35]

Notable Features and Key Takeaways

a) CMU had a longstanding research partnership with NASA.
b) CMU was committed to establishing a campus on the West Coast to promote existing academic strengths and activities at the main campus.
c) CMU was able to establish CMU-SV through NASA's enhanced use lease program, which did not require a major investment to acquire and develop a parcel of land.
d) CMU-SV is proximate to its major research partner NASA, as well as potential private sector partners that are collocated at NRP or have offices in the area.
e) Program offerings at CMU-SV are aligned with employment opportunities concentrated in Silicon Valley.
f) The campus primarily focuses on research, with a relatively small academic program to support this mission.

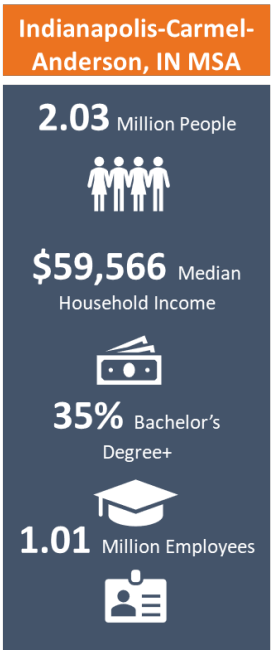
7. Case Study #2: Indiana University – Purdue University in Indiana, IN

Background Context



Indiana University-Purdue University Indianapolis (IUPUI) is Indiana's premier urban public research university and ranked #228 in the U.S. News & World Report rankings of National Universities. It is one of nine physical campuses that are part of the Indiana University system and considered one of the two core IU campuses along with IU Bloomington.[36]

Indiana University first offered classes in Indianapolis in 1891. Over time, both Indiana University and Purdue University established more education programs in the city while operating independently. In 1968, Indianapolis Mayor Richard Lugar called for "a great state university in Indianapolis" and the two institutions merged their programs and schools to create IUPUI in 1969.[37]



Drivers for IU and Purdue Merger[38]

Strengthen Higher Education Offerings in City

IU and Purdue had extensive operations in Indianapolis for decades. Aside from the professional schools, these programs were generally lackluster in their offerings and limited in scope. The private colleges and universities in the city needed advanced research facilities and training. Mayor Lugar envisioned the two institutions merging in order to pool resources and strengthen their collective academic offerings.

Create Pipeline for City Employers

In his December 14, 1968 address to the people of Indianapolis, Mayor Lugar stated that the population growth in the city required better higher education opportunities. Residents of the city should not have to relocate or travel to other towns for advanced training. Instead, they should be able to access high quality continuing education and training at a premier institution within the city.

Threat to Revoke Funding

Although IU and Purdue had been negotiating a "Joint Regional Campus," those talks stalled after Purdue administrators sought more money for their existing campus property and thought the proposed downtown site was too ambitious and expensive to develop. Mayor Lugar threatened to lobby state lawmakers to revoke funding for the institutions and create a state board of regents that would oversee state universities.

Process and Administration

On January 13, 1969, administrators agreed on the academic mission assignments that the two universities would assume after the merger. The four phase "Time-Action Plan" charted target dates for actions necessary to complete and implement the merger, from trustee approvals to management of food service operations. They agreed that IU would oversee arts and social sciences departments, as well as some biology and chemistry programs. Purdue would manage engineering, technology, agriculture, mathematics, physics, psychology, and other programs. IU's professional schools in Indianapolis – which included law, dentistry, medicine, physical education, social work, and art – would remain under IU.[39]

Today, IUPUI is led by Chancellor Nasser H. Paydar. Chancellor Paydar reports up to Indiana University President Michael McRobbie, who oversees all of IU's campuses. While Purdue confers degrees for the separate programs that it oversees at IUPUI, it is unclear from publicly available information how the two institutions share administrative responsibilities today.

Investment

There is no publicly available information on the costs of the merger between IU and Purdue to establish IUPUI.

Curriculum

IUPUI is home to two colleges and 17 schools that confer degrees through Indiana University and Purdue University. It offers 178 master's degrees, 61 doctoral and professional degrees, and 67 graduate certificates across 16 of its schools. The campus includes over 100 research centers, including 11 Signature Centers, and was awarded 55 patents in 2016.

Industries[40]

As Mayor Lugar envisioned in 1968, IUPUI has geared its curriculum towards supporting the major industries and filling employment needs in the metropolitan area. IUPUI is located in the Indianapolis-Carmel-Anderson, IN MSA where, as shown in Figure 5 below, the largest industries are classified as Health Care & Social Assistance; Manufacturing; and Retail Trade.

Figure 5: Employment by Industries in Indianapolis-Carmel-Anderson, IN MSA

In an MSA that employs 1.01 million people, many of the occupations are affiliated with healthcare institutions including professional and support functions per Figure 6 below. The largest employers in this area include St. Vincent Hospitals, IU Health, Eli Lily & Co., and Community Health Network.[41]

Figure 6: Employment by Occupations in Indianapolis-Carmel-Anderson, IN MSA

Partnerships

While it is not apparent that IUPUI has established research partnerships on its campus, it is part of a major development effort just north of its campus across the Fall Creek River. *16 Tech* is a $160 million, 60-acre innovation district currently under construction just north of the IUPUI campus. The development is envisioned as a live, work, play, learn community that will bring together experts from research and industry in fields including life sciences, manufacturing, and engineering. Partners span industry, government, philanthropy, and universities including IUPUI, Indiana University, and Indiana University School of Medicine. The City of Indianapolis committed $75 million towards infrastructure, Indiana University is investing $20 million over five years to outfit its space, and the Lilly Endowment gave $38 million in grants for infrastructure upgrades, including the development of a bridge that will connect 16 Tech to IUPUI, the IU School of Medicine, and four hospitals.[42,43]

The first phase includes over 2 million square feet of office, labs, co-working, and makers spaces that will be developed over 10 years and is expected to create nearly 3,000 jobs. The first building – the 120,000 square foot $30 million Advanced Research and Innovation building – is under construction and will house the Indiana Biosciences Research Institute, the Central Indiana Corporate Partnership, and IU School of Medicine's Indiana Center for Regenerative Medicine.[44]

Figure 7: Subset of Partnerships at 16 Tech

Campus

IUPUI is an urban campus that encompasses over 500 acres in downtown Indianapolis. It serves as the primary campus for the Indiana University School of Medicine, the largest medical school in the state, and the School of Dentistry, the only dental school in the state.

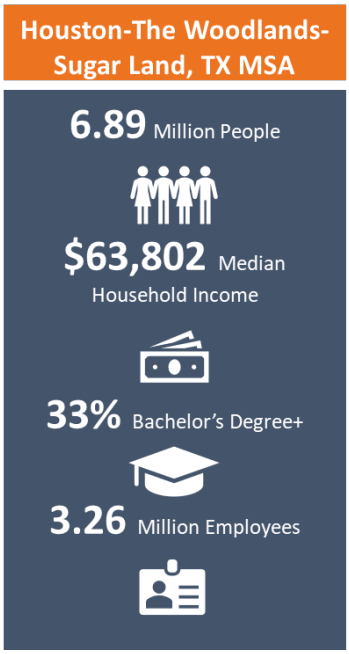
IUPUI recently broke ground on Innovation Hall, a new classroom building that will house the teaching and research needs for the Purdue School of Science, Purdue School of Engineering and Technology, and the IU School of Informatics and Computing. The colocation of these three schools is intentionally designed to foster collaboration across various disciplines.[45]

Notable Features and Key Takeaways

a) The merger of IU and Purdue was politically driven by the city's mayor
b) Although IUPUI represents the oldest example, it represents the merger of two existing satellite campuses to better serve higher educational needs of the growing regional economy
c) IUPUI has over $1 billion of economic impact in Indianapolis, received over $7 billion in research grants and awards since its founding, and employs over 8,000 faculty and staff
d) Over its 50 years, IUPUI has more than 200,000 graduates, many of whom stayed in Indiana

8. Case Study #3: Texas Medical Center in Houston, TX

Background Context



Texas Medical Center (TMC) is the world's largest medical complex located four miles southwest of downtown Houston, encompassing 50 million developed square feet and employing over 110,000 people. TMC is comprised of 61 member institutions, including the University of Texas Health Science Center at Houston (UTHealth), MD Anderson Cancer Center, and the Baylor College of Medicine, among others.[46]

The MD Anderson Foundation received $19 million upon Monroe Anderson's death and envisioned constructing a "City of Medicine" in Houston. After the state legislature appropriated $500,000 for a state cancer hospital, the trustees of the foundation conferred with the president of the University of Texas to establish the MD Anderson Hospital of Cancer and Research of The University of Texas in 1942 near Hermann Hospital, which opened in 1925. After the foundation purchased 134 acres of land from the City, it offered the Baylor College of Medicine land and startup funding to move the institution to Houston from Dallas in 1943. In 1945, the TMC was chartered as a non-profit and restricted land use at the Center for non-profit medical care, teaching, and research while allowing institutions to operate autonomously. Over time, TMC oversaw land distribution and common area development. TMC gifted over 113 acres of land and contributed substantial funds towards construction for institutions at the Center, which catalyzed the Center's growth and research prowess as more hospitals and research organizations flocked to TMC.[47] Today, the campus is home to three medical schools, six nursing schools, two universities, two pharmacy schools, a community college, and a high school with a curriculum focused on life sciences.[48]

In April 2018, TMC announced TMC^3, a new multi-institutional translational research campus aimed at establishing Houston as the "third coast" for life sciences in the country. This 1.5 million square foot development across 37 acres is expected to drive $5.2 billion into Houston's economy and create approximately 26,000 jobs. The five founding institutions include Texas Medical Center, Baylor College of Medicine, Texas A&M University Health Science Center, The University of Texas Health Science Center at Houston (UTHealth), and The University of Texas MD Anderson Cancer Center.[49]

Drivers for Campus Expansion

Need for Additional Lab Space

During TMC's first ever campus-wide strategic plan effort in January 2014, four of the TMC's largest member institutions approached TMC about purchasing land for additional lab space. TMC saw this as an opportunity to increase efficiency through shared resources and advance collaborative research.[50]

Attract Research Funding and Industry Collaboration

One of TMC's goals is to foster collaboration among the 61 member institutions, especially as the trend in NIH funding has been towards rewarding more multi-institutional research. The TMC also revised the covenants for the site in order to allow for-profit use of land, as this will allow for commercial partnerships, and an influx of venture capital, as well as create an environment more conducive to research commercialization.

Process and Administration

TMC is operated by an executive team headed by President and CEO William McKeon. He is charged with leading TMC's 61 member institutions to drive life science advancements through research collaborations among the members. In 2014, McKeon led TMC through a strategic plan effort, which resulted in the commitment to build out five institutes that would foster collaboration including innovation, health policy, clinical research, regenerative medicine, and genomics. McKeon is also overseeing TMC^3 and helped launch the TMC Venture Fund, a $25 million fund aimed to help fill the early-stage funding gap in Houston for technologies and companies in the healthcare and life sciences space.[51] The higher education institutions located at TMC maintain their independent academic programs.

Investment

The driving force behind the TMC's founding and growth was the MD Anderson Foundation's initial investments in land and subsidizing construction costs for new institutions in Houston. The trustees of the foundation were also able to leverage their relationships to bring the state-funded cancer center and Baylor College of Medicine to the TMC. Through the remainder of the 20th century, the TMC was able to create a concentration of hospitals, universities, and research institutions by offering free land and covering some portion of construction costs, which lowers the barrier to entry for a new or relocating institution.

As for the TMC^3, while overall costs are not available, there is information related to the TMC^3 Collaborative. The campus's 250,000 square foot combined research building has an estimated development cost of $246 million. It will be owned by TMC and funded through bond financing secured by long-term leases from the aforementioned founding institutions. TMC will contribute $40 million and the other four institutions will contribute a combined total of $36.45 million.[52]

Curriculum

As mentioned previously, TMC is home to three medical schools, six nursing schools, two universities, two pharmacy schools, a community college, and a high school with a curriculum focused on life sciences.[53] Three of the institutions that offer graduate degrees, highlighted below, include Baylor, Texas A&M, and UTHealth.

The Baylor College of Medicine is comprised of the Medical School, the Graduate School of Biomedical Sciences, the School of Allied Health Sciences and the National School of Tropical Medicine.

The Texas A&M Health Science Center's Institute of Biosciences and Technology is located on the campus and offers a Ph.D. in Medical Science.

UTHealth has located the following schools at TMC: The University of Texas Graduate School of Biomedical Sciences at Houston, School of Public Health, School of Dentistry, School of Nursing, McGovern Medical School at UTHealth, Harris County Psychiatric Center, and School of Biomedical Informatics.

Industries[54]

TMC both educates and employs health care professionals. Three of the largest employers in this area that employs 3.26 million people overall – Memorial Hermann Health System, The University of Texas MD Anderson, and The Methodist Hospital System – have a presence at TCM. As Figure 8 shows, the largest industries in the Houston-The Woodlands-Sugar Land, TX MSA where TMC is located are classified as Health Care & Social Assistance, Retail Trade, and Manufacturing.[55] Figure 9 below demonstrates that although doctors and nurses are not the most popular occupations, management and support functions that are critical to operating hospitals, research facilities, and higher education institutions make up a significant share of jobs in the area.

Figure 8: Employment by Industries in Houston-The Woodlands-Sugar Land, TX MSA

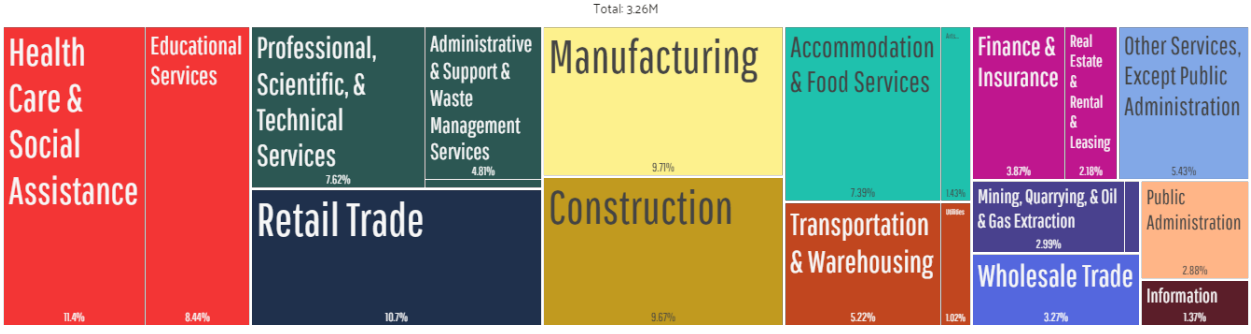


Figure 9: Employment by Occupations in Houston-The Woodlands-Sugar Land, TX MSA

Partnerships

After the January 2014 strategic planning meeting among the campus's 61 member institutions, TMC announced the goal to establish five new institutes that will foster collaboration among the members.[56]

Innovation

The goal of the TMC Innovation Institute is to become the global leader in health and life sciences innovation. The Institute offers six different programs for entrepreneurs, including three that are partnerships with AT&T, Johnson & Johnson, and ABB, respectively. The Institute is sponsored by seven companies including Accenture, BD, Insperity, TAMM Net, Greenlight Guru, GL CHEMTEC INTERNATIONAL, and Sophic Synergistics LLC.

The Institute also partners with The Biomedical Advanced Research and Development Authority (BARDA), Division of Research, Innovation and Ventures (DRIVe), which is working with a network of accelerators across America to promote national health security innovation. The partnership aims to populate the R&D pipeline with health security products and technologies that are ready to advance to later-stage funding outside of the accelerator network for clinical development and commercialization.

Health Policy

The goal of the TMC Health Policy Institute is to drive innovative, evidence-based health policy initiatives by serving as a health policy information resource, increasing access to care through innovative initiatives, and improving future health policies.

Clinical Research

The goal of the TMC Clinical Research Institute is to advance TMC to become the world's leader in transformational clinical research to benefit human health. The Institute will create a Business Council of institutional leaders that collectively represents the TMC and guides the Institute's offerings to both TMC researchers and industry partners. The Institute will also partner with Deep 6 AI to provide member institutions with a unique tool that utilizes artificial intelligence to find more, better-matching patients for clinical trials in minutes. Finally, the Institute will manage the TMC's R&D Network and Institutional Review Board to facilitate multi-institutional studies and to ensure institutional reliance on a single panel review.

Regenerative Medicine
Although it has not yet launched, the Regenerative Medicine Institute aims to lead the world in discovering, developing, and delivering curative regenerative therapies.

Genomics
Although it has not yet launched, the Genomics Institute aims to create the world's premier clinical genomics program.

Figure 10: Subset of Partnerships at TMC Innovation Institute

TMC^3

The TMC^3 Collaborative Campus will accelerate research discoveries to improve human health throughout the world among the five founding institutions *Texas Medical Center, Baylor College of Medicine, Texas A&M University Health Science Center, The University of Texas Health Science Center (UTHealth), and The University of Texas MD Anderson Cancer Center.*

Figure 11: TMC^3 Partners

Campus

TMC^3 will include 1.5 million square feet of collaborative research space for the five founding institutions, 250,000 square feet of core labs and amenities, a 410-room hotel and conference center with 50,000 square feet of meeting space, and up to 400,000 square feet for private health care companies interested in working near research institutions.[57,58]

Notable Features and Key Takeaways
a) Consolidation of 61 health-related institutions at TMC has occurred over the last 80 years due to investments by the MD Anderson Foundation and TMC to offer free land and subsidized construction costs. b) TMC^3 was driven by a desire among the research institutions for more lab space and a commitment by TMC to facilitate multi-institutional collaborative research. c) TMC plans to leverage the concentration of research and medical institutions at the Center to build out commercialization opportunities and strengthen partnerships with industry. d) Restrictive original land use covenants had to be revised to allow for-profit uses. e) While it is not readily apparent that any governmental entities committed resources to the project, TMC required trustee approval for private sector use of this land. Also, some of the founding institutions, which are public, committed to long-term leases, which allowed TMC to obtain bond financing.

9. Case Study #4: Virginia Tech in Arlington, VA

Background Context

Virginia Polytechnic Institute and State University, also known as Virginia Tech (VT), was founded in 1872 as a public land grant university in Blacksburg, Virginia. VT is ranked #74 in the *U.S. News & World Report* rankings of National Universities. The university has nine colleges and one graduate school.

Virginia Tech Main Campus
Blacksburg, Virginia

34,131 Students

#46 National Science Foundation R&D Funding

Arlington Campus
Arlington, VA

160 Students

Established in **2005**

Outside of the main campus, VT has locations in the National Capital Region, throughout the Commonwealth of Virginia, and in Switzerland.[59]

VT's first satellite presence in the National Capital Region, also known as the Washington, D.C. metropolitan area, was established in 1969 in Reston, VA. VT moved its Advanced Research Institute to Arlington in 2005 and opened the Virginia Tech Research Center – Arlington in June 2011. VT maintains seven facilities throughout the region in Alexandria, Arlington, Fairfax, Falls Church, Leesburg, Manassas, and Middleburg. Locations outside of Arlington offer a variety of programs including architecture and urban design, watershed monitoring, equine research, and an equine medical center.[60,61]

In November 2018, VT announced plans to build an Innovation Campus in Alexandria as part of the tech-talent pipeline package created by the Virginia Economic Development Partnership for Amazon's second headquarters, referred to as HQ2.[62] This case study will focus on the VT Research Center – Arlington and the future Innovation Campus.

Washington-Arlington-Alexandria, DC-VA-MD-WV MSA

6.22 Million People

$99,669 Median Household Income

52% Bachelor's Degree+

3.34 Million Employees

VT RESEARCH CENTER-ARLINGTON

Drivers for Additional Campus

Expand Presence in National Capital Region

The impetus for establishing the VT Research Center-Arlington was designed to expand VT's footprint in the region, consolidate research centers and institutes into one location, and offer greater opportunity for partnerships given proximity to public agencies and private organizations. During this time, a number of major firms and government contractors were moving to Arlington to be closer to federal agency activity including Accenture, CACI, Leidos, and ESI International.

Process and Administration

VT sought to consolidate its various research centers throughout the National Capital Region. These included the Advanced Research Institute, Biocomplexity Institute of Virginia Tech, Institute for Critical Technology and Applied Science, Arlington Innovation Center for Health Research, and the Institute for Society, Culture, and Environment.[63]

Dr. Nick Stone currently serves as the Interim Senior Director of National Capital Region Operations in the VT Research Center – Arlington. Dr. Stone represents the Provost's Office in the region and helps with transition planning and change-management initiatives.[64] It is unclear how this role will be impacted by incoming leadership at the Innovation Campus.

Investment

The VT Research Center – Arlington is owned by the Virginia Tech Foundation, but it is unclear how much the foundation paid to acquire and develop the property. Minutes from an October 2008 Arlington County Board meeting detail funding for the project through $25,220,000 in revenue bonds issued by Montgomery County, VA but approved by Arlington County.[65] One publication cites the development cost at $90 million.[66]

Curriculum

VT currently offers more than 45 graduate degree and certificate programs across the National Capital Region in Alexandria, Arlington, and Falls Church that are aligned with major industries in the region ranging from computer science and engineering to government affairs and public administration.[67] Executive Programs include an Executive Master of Natural Resources Program and Pamplin College of Business Executive MBA. Online programs in Information Technology and Natural Resources are also offered. Graduate programs include:

- Architecture
- Civil and Environmental Engineering
- Computer Science
- Data Analysis and Applied Statistics
- Education
- Electrical and Computer Engineering
- Evening MBA
- Government and International Affairs
- Industrial and Systems Engineering
- Marriage and Family Therapy
- Master of Engineering in Computer Science
- Nuclear Engineering
- Public Administration and Policy
- Science and Technology Studies in Society
- Urban Affairs and Planning

Research at VT Research Center: Arlington is organized around cyber-security; medical technologies and imaging; policy informatics; alternative energy; and global, national and community security. Labs, centers, institutes, and initiatives within the National Capital Region include: [68]

Labs

- Data Mining and Visualization Lab
- Complex Networks and Security Research Lab
- Computational Bioinformatics and Bio-imaging Laboratory (ECE)
- Crowd Intelligence Lab
- Mobile Computing Lab
- Nuclear Science and Engineering Lab (ICTAS)
- Occoquan Watershed Monitoring Laboratory (CEE)
- System Dynamics Lab
- System Performance Lab

Centers

- Advanced Research Institute
- Arlington Innovation Center: Health Research
- Center for Energy and Global Environment
- Center for Human-Computer Interaction
- Center for Power Electronics Systems
- Discovery Analytics Center (ICTAS)
- Hume Center for National Security and Technology (ICTAS)
- Institute for Policy and Governance
- Global Issues Initiative (ISCE)

- Marion duPont Scott Equine Medical Center
- Marriage and Family Therapy
- Middleburg Agricultural Research and Extension Center
- Virginia Center for Coal and Energy Research

Institutes

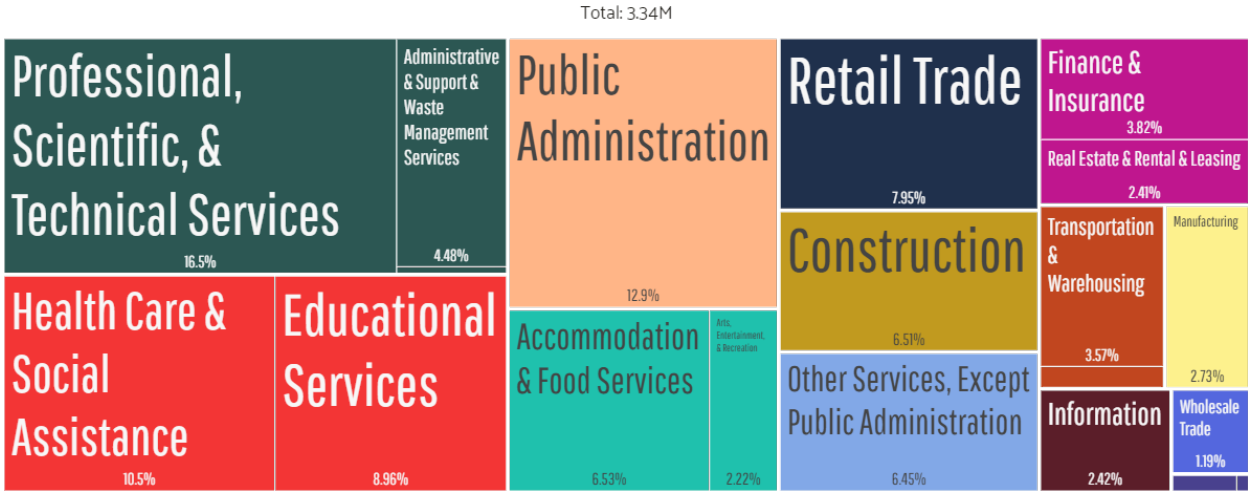
- Institute for Critical Technology and Applied Science
- Institute for Society, Culture and Environment
- Virginia Tech Carilion Research Institute
- Virginia Tech Transportation Institute

Initiatives are focused on connected and autonomous vehicles, cyber/cyber-physical systems security, data analytics, and the Urban Living Lab, which leverages full-time interactions between practitioners, researchers, and students in a real-world learning environment that integrates co-creation, exploration, testing, analysis, and innovation in operational settings.[69]

Industries[70]

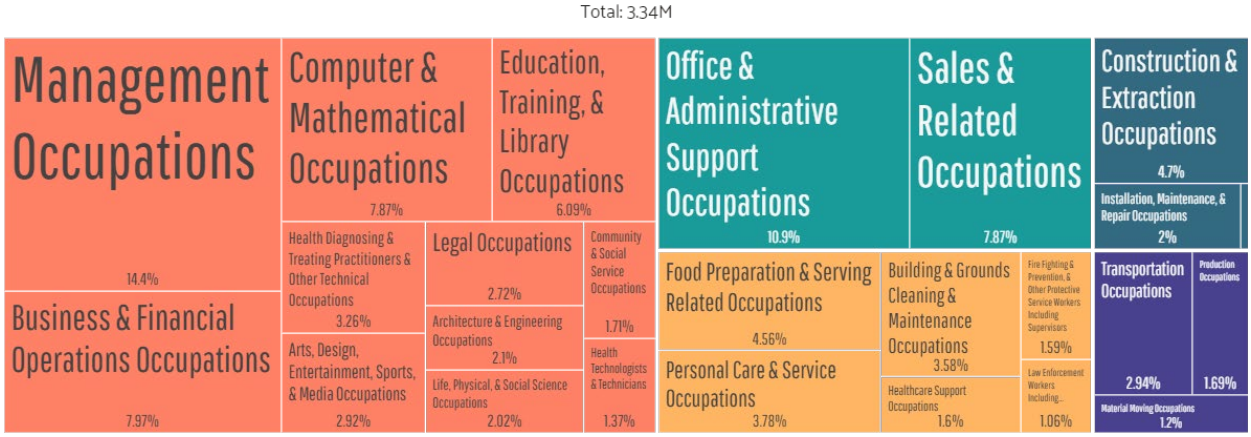
The curriculum and research that are currently offered at the VT Research Center-Arlington are complementary to the region's largest industries. This satellite campus, located in Arlington, is considered part of the Washington-Arlington-Alexandria, DC-VA-MD-WV MSA. The largest industries, as shown in Figure 12 below, are classified as Professional, Scientific, & Technical Services; Public Administration; and Health Care & Social Assistance.

Figure 12: Employment by Industries in Washington-Arlington-Alexandria, DC-VA-MD-WV MSA



This MSA employs 3.34 million people, approximately one-third of whom are in management, business and financial, or computer and mathematical roles, as evidenced in Figure 13. Outside of the federal government, the largest employers in this region include Medstar Health, Marriott, INOVA Health, Booz Allen Hamilton, and the University of Maryland. [71]

Figure 13: Employment by Occupations in Washington-Arlington-Alexandria, DC-VA-MD-WV MSA



Partnerships

VT enhanced or established partnerships with public and private organizations at both satellite campuses in order to advance its research, gain greater visibility in the region, and identify employers that will hire its students.

Cyviz, a global technology provider based in Norway that has a long-standing relationship with VT, donated visualization and collaboration equipment valued at over $500,000, which helps researchers collaborate and present their work effectively to potential partners or funders. The company also has a regional office in the Arlington facility.[72]

The *Virginia Tech Applied Research Corporation* (VT-ARC), a non-profit R&D organization affiliated with VT, leverages the $500 million annual multidisciplinary research and innovation ecosystem of the university to offer superior analytic and technology solutions to clients across multiple domains, especially those customers focused on national security. VT-ARC has an office in the VT Research Center – Arlington and includes the Air Force, Marine Corps, Department of Defense, and US Special Operations Command among its partners and clients.[73]

The *Advanced Research Institute* (ARI), also located at the VT Research Center – Arlington, is a VT entity focused on developing an internationally recognized research and development center in engineering and technology that provides leadership in fostering a culture of innovative research, new technology development and demonstration, high-tech manpower training, and lifelong learning. ARI's research is focused on the energy and power area, and project sponsors include the US Department of Energy; Bureau of Ocean Energy Management; National Science Foundation; VA Department of Mines, Minerals, and Energy; SERDP; ESTCP; and the Qatar Foundation.[74]

VT partnered with *Arlington County* and *IBM* in June 2009 on an emergency system informatics initiative. This effort will build of VT's experience developing sophisticated high-performance computing-based methods for analyzing social systems and societal infrastructures during disasters. Arlington will serve as a lab where researchers at VT and IBM can develop policies and systems to bolster emergency prevention and response.[75]

Figure 14: Examples of VT Partnerships at VT Research Center-Arlington

Campus

VT made a strategic decision to invest in developing a state-of-the-art research facility in northern Virginia where the institution could increase and strengthen the visibility of its brand and develop research partnerships with federal agencies and private corporations. The VT Research Center-Arlington became this flagship investment in 2005, and the Innovation Campus will take up the mantle.

The VT Research Center-Arlington is a seven story 144,000 square foot LEED-certified facility in Ballston. The building is among the best-connected research facilities in the world, incorporating next-generation Internet with direct fiber access to Internet2 and multiple federal networks. High-performance connectivity links this facility to the main campus and other major universities. The network provides access to international peering points in New York, Chicago, Seattle, Los Angeles, and Florida, and the building includes a secure data center for high performance computing (HPC)-based research.[76] Students and researchers are collocated with industry professionals, and two floors are commercially leased.

INNOVATION CAMPUS

Drivers for Additional Campus

Leverage Amazon HQ2 Investment

Part of Amazon's incentive package to locate to Virginia included a commitment by VT, a Commonwealth research land grant institution, to establish an Innovation Campus that will build a talent pipeline to help fill the anticipated 25,000 jobs for Amazon's HQ2. This campus positions VT to fulfill the tech employment needs of companies throughout the region, partner with public and private entities on technology-related research, and drive economic development through capital investments, academic spending, job creation, and entrepreneurship.[77]

Process and Administration

The Innovation Campus will be overseen by VT President Tim Sands, Interim Provost Cyril Clarke, and others. In May 2019, President Sands launched the search for the vice president and executive director who will lead the Innovation Campus.[78] Brandy Salmon, Associate Vice

President for Innovation and Partnerships, serves as managing director of the Virginia Tech Innovation Campus and leads a cross-functional delivery team to set the vision for the campus and launch key efforts.[79,80] Sara Hooshangi was named the director of VT's master of engineering degree in computer science effective January 2020, whose focus will be on building a college-to-career centered program.[81]

Investment

VT and the Commonwealth of Virginia have committed $250 million each over the next 20 years towards the Innovation Campus. The remaining amount will require private philanthropy, industry partnerships, and other revenue streams. [82]

Curriculum

The Innovation Campus will offer four master's degrees: two in computer science and two in computer engineering.[83] The first class of students will enroll in Fall 2020 in existing space adjacent to where new academic buildings will be built. In 10 years, the campus anticipates enrolling 750 master's degree candidates and hundreds of doctoral students and postdoctoral fellows.[84] VT anticipates 50 faculty hires and a 2,000 undergraduate enrollment increase among students interested in computer science.[85]

Industries[86]

The curriculum and research that will be offered at the Innovation Campus are complementary to the region's largest industries. This satellite campus, located in Alexandria, is considered part of the Washington-Arlington-Alexandria, DC-VA-MD-WV MSA. The same statistics referenced in the Industries section above for the VT Research Center-Arlington are applicable to the Innovation Campus. The Innovation Campus, which will focus its offerings in computer science and engineering, recognizes that the industry is projected to grow 11% between 2014-2024 and that its graduates will help fill the currently 11,000 unfilled jobs in the region.

Partnerships

As described previously, the *Commonwealth of Virginia* committed $250 million over the next 20 years towards the development of the Innovation Campus.

The Innovation Campus is also part of *Amazon's* HQ2 incentive package from the Commonwealth towards a commitment to provide a pipeline for tech talent in order to fill the approximately 25,000 jobs that Amazon will bring to Northern Virginia. No additional partnerships have been announced at the Innovation Campus.

Other Partnerships

VT also entered into a partnership with Children's National Hospital to construct a 120,000 square foot biomedical research facility at the new Children's National Research and Innovation Campus, located at the former Walter Reed Medical Center site in Washington, D.C. While the Children's National Research Institute and Fralin Biomedical Research Institute at VT Carilion have partnered on research for over a decade, this expanded collaboration will include developing new drugs, software, medical devices, and treatments for various cancers and diseases.[87]

Figure 15: Examples of VT Partnerships at the Innovation Center

Campus

In June 2019, VT provided specifics about the $1 billion, 1 million square foot graduate Innovation Campus across 15 acres that will triple the university's footprint in the region. Facilities will include: 300,000 square feet of academic space and cutting-edge research-and -development facilities; 250,000 square feet of partner space dedicated to startups and corporate facilities; 350,000 square feet of housing space for students and faculty; and 100,000 square feet of retail and support spaces.[88] The development plan also includes public open space, retail, and a new Metro station. The campus will be one Metro stop away from Reagan National Airport and Crystal City and stops from Amazon HQ2.[89]

Notable Features and Key Takeaways
a) VT established the VT Research Center-Arlington after a 40+ year presence in northern Virginia to consolidate numerous university-related research centers in the National Capital Region under one roof in a proximate location to partners in the public and private sectors. b) VT is leveraging its position as Virginia's leading research land grant institution to establish a graduate Innovation Campus that would produce employees for the region's burgeoning tech industry, including major employers like Amazon. c) Programs offered at VT's satellite campuses are directly linked to the region's economy. Computer science is a critical industry in the region that is projected to grow 11% between 2014-2024 with 11,000 unfilled jobs in the region currently. d) Through its satellite campus, VT is cultivating relationships with major corporations to feed its pipeline of graduates into careers.

10. Additional University Examples

Eleven additional universities were profiled on a less in-depth basis to identify key drivers and criteria for siting satellite campus locations. For five more relevant institutional examples, high-level case studies are shown below, providing insight into the dynamic variables involved in satellite campus establishment. Key features of these cases are grouped into five categories: University Opportunities; Core Mission and Management; Linkages with Local Economy; Partnerships / Facilitators; and Background / Infrastructure / Environment. These are followed by six less comprehensive campus descriptions that highlight important takeaways.

1. ARIZONA STATE UNIVERSITY POLYTECHNIC CAMPUS: Mesa, Arizona

Background Context

Arizona State University (ASU) is a large public research university (ranked #44 by NSF) and is comprised of five campuses across the Phoenix metropolitan area and four regional learning centers throughout Arizona. As of fall 2019, the overall university had nearly 90,000 students. The university is organized into 17 colleges, featuring more than 170 cross-discipline centers and institutes. ASU has more than 400 graduate degree and certificate programs.[90]

The ASU Polytechnic Campus (ASU East) opened in fall 1996 on the former Williams Air Force Base in southeast Mesa, Arizona. At its debut, the campus offered eight-degree programs with an enrollment of 1,000 students. Studies focused on interdisciplinary sciences, engineering, management, technology and education. Industry partnerships were key to formulating the campus's distinctive (from other ASU locations) course offerings, which helped support project-based learning within specialized laboratory spaces. In 1997, a business development incubator related to new professional programs was added. Over the past 20 years enrollment has grown to over 5,000 students.[91]

In addition to ASU facilities and programs, the campus is part of the larger 600-acre Williams Campus which is also home to seven other independent, free standing educational and research related institutions.

Investment[92]

Investment information pertaining to ASU East is not available. However, ASU East is expanding its footprint into downtown Mesa. In June 2018, the City of Mesa has incentivized ASU East via an economic development effort whereby the City agreed to construct and lease a new downtown building to ASU. The building is located on city-owned land and budgeted to cost $63 million. Additional associated improvements include a 2.5-acre city plaza and innovation studio space increasing the city investment by another $7 million. The Mesa City Council approved the sale of excise tax bonds not to exceed $65 million to fund the project.

ASU's obligations include paying the city a nominal annual net rent ($100,000) and covering annual building operating and maintenance costs. City stipulations include maintaining a 750-student minimum enrollment, 40 faculty members, scholarship programs and targeted public events.

Recent Additional Out of State Investment[93]
ASU has also pursued an industry targeted satellite campus outside of Arizona. In 2020 the university is scheduled to occupy 86,000 square feet in a newly renovated mixed-use building (street level retail uses) in downtown Los Angeles, CA where it plans to focus on film industry related academic programs. ASU is contracted to pay market rent to a private landlord.

Partnerships

- One of the top 10 national recipients of NASA funds
- City of Mesa, Arizona

Notable Features and Key Takeaways	
University Opportunities	Establishing a physical presence can benefit from proximity to an existing industry
University Opportunities	Physical visibility and established, stable programs help advance additional university investments
University Opportunities	Out of state expansion can increase access to and visibility for out of state student populations
University Opportunities	Universities' national reputations can be advanced by investing in satellite facilities
Core Mission and Management Needs	Unrelated institutions can share an overall campus while also maintaining their own distinct operations and identity
Linkages with Local Economy	Opportunity and ability to tap into niche specialty markets such as film and journalism can be instrumental to justifying new campuses
Partnerships / Facilitators	Municipal funding can be a key tool in landing university partnerships

2. UNIVERSITY OF ARIZONA TECH PARK at THE BRIDGES: Tucson, Arizona

Background Context[94]

The University of Arizona (UA) Tech Park at The Bridges (The Bridges) encompasses 65 acres of a larger 350-acre master planned community of mixed-use development known as Tech Parks Arizona. UA envisions a live, work, play environment at the master planned community.[95]

UA intended to create a bioscience park to leverage the strength of its research programs. UA is ranked 21st among public universities with $687 million in research investment as of 2019. Originally named the UA Bio Park, the University rebranded it to UA Tech Park at The Bridges. UA had trouble attracting a bioscience company to the park, so it broadened the park's focus beyond bioscience to include other research areas. While other parts of the broader Tech Parks Arizona development have been successful in attracting companies and retail tenants, The Bridges has struggled. Officials from Tech Launch Arizona cite the 2008 recession as a major roadblock to the park's development. It has only recently broken ground on the first vertical structure after building horizontal infrastructure in the early part of the last decade. Tech Parks Arizona decided to bring in private sector developers to help advance the development of the park, which is discussed in greater detail in the Partnerships section below.[96]

Operations
The tech parks are owned by the Arizona Board of Regents on behalf of the University of Arizona. Tech Parks Arizona operates and manages the UA Tech Park at The Bridges and the UA Tech Park at Rita Road. Campus Research Organization, a nonprofit organization, assists the University in developing, operating, leasing, and promoting both tech parks at The Bridges and Rita Road.

Planned Facilities
The Bridges has four district zones: Technology, University, Business, and Corporate.

- Technology Zone: Long-term plans at this zone include up to five office buildings, a hotel and conference center, parking structure, and 400,000 SF of office and lab space.
  - The first building in this zone will offer 120,000 SF of office space for small to mid-sized tech firms. Half of the office space is committed to UA for commercialization and innovation activities including new offices for Tech Launch Arizona, space for business incubation programs for the University of Arizona Center for Innovation, and innovation space for students.
  - The second lab and office building will be six stories with 180,000 SF of space.
- University Zone: This zone will be home to industry and academic driven centers focused on the strengths of UA that will offer education and career opportunities.
- Business Zone: This zone is dedicated for large technology companies interested in building their own facilities and partnering with UA on research opportunities.
- Corporate Zone: This area offers corporations the opportunity to be an anchor tenant through a multi-building campus setting within the tech park.

Investment

The University acquired an industrial park from IBM with the intent to transform it into a university research park in 1994. In 2007, the University acquired a second 54-acre property closer to the main campus to develop a second research park, now known as the UA Tech Park and The Bridges. In 2009, the University received a $4.7 million grant from the U.S. Department of Commerce's Economic Development Administration for infrastructure improvements.

Partnerships

- In May 2018, The Boyer Co. was selected as a development partner for the Technology Zone in The Bridges.
- Tech Parks Arizona also selected Bourn Cos. as the master developer of The Village, a 175-acre portion of the broader Tech Parks Arizona development. Bourn purchased 112 acres from the KB Home and Lennar Homes joint venture that was originally planned for housing at The Bridges.[97]

Notable Features and Key Takeaways	
University Opportunities	Leverage research area strengths
Partnerships / Facilitators	Failed to attract bioscience partners to research park

3. CORNELL TECH: New York City, New York

Background Context

Cornell Tech is a technology, business, law, and design campus of Cornell University located on Roosevelt Island in Manhattan, New York City.[98] It includes the Jacobs Technion-Cornell Institute, a joint academic venture between Cornell and the Technion-Israel Institute of Technology (Technion). Technion compliments Cornell's program with its focus in technology transfer aiming to bridge the transition of scientific and technological discovery to successfully commercialized innovation.[99] (See also Appendix B for referenced article.) Established in 2007, T^3 (Technion Technology Transfer) is largely responsible for producing 424 patents from Technion innovations in addition to 845 pending patents as of 2011. T^3 has strategic partnerships with Microsoft, IBM, Intel, Philips, Johnson & Johnson, Coca-Cola, among others. This joint venture, aptly branded as Connell Tech, began operations in 2012 at temporary space in New York City while the permanent campus was under construction.[100] The Roosevelt Island campus's 5-acre first phase opened in 2017, with planned potential to expand to 12 acres by 2037.[101]

Process[102]

In 2010, New York City solicited proposals from top-ranked applied sciences universities to establish a campus on one of several city-owned sites in addition to offering $100 million in capital subsidies. Drivers for this initiative included:

- Attracting a premier nationally ranked academic institution with programs in engineering and applied sciences.
- Diversifying the local economy.
- Bolstering tech company and talent growth in New York City to better compete with established major hubs in Boston and the San Francisco Bay Area.

Seven formal proposals were submitted for various locations:

- Amity University;
- A joint bid of Carnegie Mellon University and Steiner Studios;
- Columbia University;
- The joint bid of Cornell University and Technion–Israel Institute of Technology;
- A six-way bid comprised of New York University, University of Toronto, University of Warwick, Indian Institute of Technology Bombay, City University of New York, and Carnegie Mellon;
- A four-way bid comprised New York Genome Center, Mount Sinai School of Medicine, Rockefeller University, and State University of New York at Stony Brook;
- A joint bid of Stanford University and City College of New York.

Within a year, NYC selected Cornell University and its partner. As proposed, at build out, Cornell Tech was projected to add 8,000 university personnel and incubate 600 companies, leading to $23 billion in economic benefits and an additional $1.4 billion in local taxes during its first three decades of operation. Reported drivers for Cornell University included:

- Accessing new industry partnership and talent recruitment (as compared to its rural upstate home campus location).
- Enhancing its land-grant mission to serve all of New York state.
- Expanding presence in New York City was already an established institutional goal.
- Leveraging a partner: international platform and proven track record in economic development / private sector corporate growth in tech industries.

Investment[103]

In addition to New York City's free land and $100 million contribution, Cornell secured a $350 million gift from an alumnus dedicated to funding the full cost of implementing the first phase of campus development; a $133 million gift by Qualcomm founder and alumnus; Verizon Communications provided $50 million for an executive education center; and Bloomberg Philanthropies provided a $100 million. Not counting the land value, the gifted capital contribution totaled over $700 million. Illustrative Results: 14% of the graduates have founded 60 startups since 2014 creating 250 new jobs; 85% of the graduates have secured full-time employment in the tech industry; and 21 applications have resulted in six patents.

Partnerships[104]

- New York City Mayor's office and New York City Economic Development Corp.
- Academic Partner: Technion–Israel Institute of Technology
- Cornell University Fee Developer and Joint Venture Partners: Forest City Ratner Companies, Hudson Companies and Related Companies

Notable Features and Key Takeaways	
University Opportunities	City role and capital commitment created low carry cost land contribution and development expense conditions
University Opportunities	Cornell participates in development partnership return on investment
University Opportunities	Employed a satellite distinctive campus name (Cornell Tech)
Core Mission and Management Needs	The Campus Master Plan highlights a mix of uses maximizing internal connectivities among academic, research and commercialization spaces as well as convenient external location linkages
Core Mission and Management Needs	Cornell's program streamlined its traditional research to corporate licensing steps to provide a readier path for its graduates and faculty to enter into business
Partnerships / Facilitators	Leveraged projections of community wide economic benefits to gain support
Partnerships / Facilitators	Multi-faceted municipal incentives were instrumental, including tax abatements, on top of which significant private contributions were unleashed
Partnerships / Facilitators	Used third party development partners to leverage outside capital
Background Infrastructure / Environment	Solicitation process was site agnostic, but offered several City-owned sites for free
Background Infrastructure / Environment	Cornell rallied local business alumni combined with a team of consultants to help frame their concept

4. UNIVERSITY OF MICHIGAN: Detroit, Michigan

Background Context

The University of Michigan (U-M) was founded in 1817 in Detroit but moved its flagship campus to Ann Arbor in 1837. U-M comprises 19 schools and colleges with regional campuses in Dearborn and Flint. It is ranked by both the National Science Foundation and the National Institutes of Health (NIH) as the second highest recipient of annual research and development funding (after Johns Hopkins. Its expenditures approached $1.5 billion in 2017, 56% of which was Federally funded, primarily from the NIH.[105]

Although U-M has been continuously engaged in Detroit-based community partnerships, a physical presence was not reestablished until the Detroit Center opened two miles north of downtown in 2005. This community-focused facility functions as an office to support research projects, outreach initiatives and U-M programs involving Detroit citizens and organizations. Demand for physical space resulted from growing community partnerships.[106]

Planned Facilities and Programs[107]

A recently conceived Detroit Center for Innovation will be a 190,000 square foot research and education center operated by U-M located on a 14-acre multibuilding mixed-use site (former Wayne County Jail site) in downtown Detroit. Programs will focus on high-tech research, education and innovation (including incubator and startup services) with capacity for 1,000 graduate and senior-level undergraduate students pursuing advanced degrees in disciplines including mobility, artificial intelligence, data science, cybersecurity and financial technology. Construction is slated to begin in 2021.

Investment[108]

The $300 million Detroit Center for Innovation project is made possible by a gift from Detroit native and U-M alumni Stephen Ross and gifts from Dan Gilbert and other donors.

Partnerships[109]

- Michigan Governor Gretchen Whitmer
- Detroit Mayor Mike Duggan
- Wayne County Executive Warren Evans
- Stephen M. Ross, alumnus, Detroit native, and chairman of Related Companies
- Matt Cullen, CEO of Bedrock

Notable Features and Key Takeaways	
University Opportunities	Historic university commitment to Detroit with a renewed physical presence
University Opportunities	Major metropolitan downtown geography and partnership commitments
Linkages with Local Economy	Facility and program targeting graduate level workforce and economic development through entrepreneurship and innovation
Partnerships / Facilitators	Major metropolitan downtown geography and partnership commitments
Partnerships / Facilitators	Alumni endowment

5. SCRIPPS RESEARCH INSTITUTE: Jupiter, Florida

Background Context[110]

Scripps Research**,** previously known as The Scripps Research Institute (or TSRI), is a nonprofit American medical research facility that focuses on research and education in the biomedical sciences. Scripps Research began in 1924 when philanthropist Ellen Browning Scripps established the Scripps Metabolic Clinic and Scripps Memorial Hospital in La Jolla, California. The Metabolic Clinic separated from the hospital in 1946, expanded its research capabilities in medical sciences. After decades of growth, the institute launched a graduate program, The Kellogg School of Science and Technology, focused on the integration of cell and molecular biology, structure and chemistry. Scripps Research is the largest private scientific non-profit biomedical institute in the country comprising 250 laboratories employing 2,400 scientists, technicians, graduate students, and administrative and other staff. Accomplishments include 70+ spin-off companies and 1,000+ US patents.

Existing Florida Facilities and Programs[111]

In 2003, Scripps Research announced the establishment of a major science center in Florida that would occupy three buildings (350,000 square feet) on 30 acres situated in Palm Beach County's innovation corridor adjacent to and adjoining the Florida Atlantic University. Completed in 2009, operations focus on biomedical research, chemistry, neuroscience, immunology and infectious disease, molecular medicine and technology development and drug discovery.

Investment[112]

Scripps Research was incentivized to expand to Jupiter Florida via funding by a State of Florida bill for economic development purposes ($310 million in Federal stimulus funds for start- up operations) in addition to $200 million from the Palm Beach County. According to the provisions of project specific Florida legislation, Scripps Research will not expand beyond California or Florida for 12 years; it will employ at least 545 employees in Florida within seven years; and it will reinvest up to $155 million in royalty income in the state's Biomedical Research Trust Fund. Scripps Research is also obligated to support education in the state by collaborating with Florida universities, colleges, and academic institutions, to offer graduate programs and provide onsite educational opportunities for high school students. The county was responsible for building the facility and temporary laboratory space.

Otherwise, Scripps Research relies on grants and contracts to provide funding for a significant portion of the institute's research. This revenue is derived primarily from the National Institutes of Health and other federal agencies. In addition, grantors include, among others, the American Cancer Society, the American Heart Association, the Cystic Fibrosis Foundation, the Leukemia & Lymphoma Society, and the Juvenile Diabetes Association. Gifts from individuals and private foundations provide additional sources of funding.

Partnerships[113]

- The Florida Atlantic University (FAU) Charles E. Schmidt College of Medicine and The Scripps Research Institute have established a dual M.D./Ph.D. degree program to provide rigorous training for talented students pursuing a clinician-scientist career path.

Notable Features and Key Takeaways	
University Opportunities	Out-of-State facility
University Opportunities	Alternative non-university type of program
Core Mission and Management Needs	Graduate programs added later
Partnerships / Facilitators	Academic programming partnership

6. OTHER EXAMPLES

University of Chicago Booth School of Business (Chicago) in London and Hong Kong[114]
With its main campus in downtown Chicago, the Booth School of Business (second oldest business school in the US behind Wharton) expanded internationally to London and Hong Kong. Expanding its program overseas provides a global platform that facilitate alumni outreach, diversifies business networks and enhances branding. In addition to offering its Executive MBA program overseas, the school supports centers for research in Paris, Beijing and New Delhi primarily in the fields of finance, economics, accounting and marketing. Student enrollment statistics for the June 2019 class comprises 240 students, half with advanced degrees, 13 years of work experience of which the most popular industries include technology, manufacturing, investment banking / brokerage, consulting, healthcare and government / non-profit / education. Partnerships in the energy industry include corporate sponsors such as Chevron, Nextera Energy and Exelon. The program offers entrepreneurial ventures through its Global New Venture Challenge, an accelerator program that has graduated over 160 startup companies.

Notable Features and Key Takeaways

- Successful U.S. based selected program replicated overseas.
- Captures attention and support of major established global corporations.

Colorado State University (Fort Collins) Global Campus[115]
CSU Global is an online campus that was established in 2007 and is headquartered in the Denver suburb of Aurora, Colorado. CSU Global offers 12 online master's degree programs with 21 specializations. The university concentrates on non-traditional, adult professionals and students who do not have ready access to the university's traditional home campus. It is the first regionally accredited 100% online state university in the country. It was legally sanctioned as a third, independent university in 2009, when Colorado's governor signed into law the State of Colorado Senate Bill 09-086 declaring the establishment of the CSU Global as an online university that is part of the Colorado State University System. As such, CSU defines itself as "the first statutorily-defined, non-profit, online state university" in the country.[116] It was funded using a $12 million loan from university leadership (the CSU Board of Governors), which has already been paid back. Graduate student enrollment totals approximately 4,000 students.

Notable Features and Key Takeaways

- Minimal traditional physical administrative support space needed located in a major metropolitan growth area some distance from more rural home campus location.
- Only 100% online program example.
- Lower cost accessible delivery of education.

George Mason University (Fairfax) in Prince William County, Virginia[117][118]
GMU is based in the City of Fairfax, Virginia and expanded into Manassas, Virginia in 1997. The expansion was a strategic decision to offer synergistic science and technology programs by locating the campus in Innovation Technology Park, a 1,500-acre university-anchored suburban

corporate research park in Northern Virginia being marketed by the Prince William County Department of Economic Development. Innovation Technology Park is home to government agencies and emergent technology companies, that are conducting cutting-edge research. GMU was heralded as an anchor user in the County's effort to market the larger business park, which now includes tenants ATCC, the state-of-the-art COPT DC-6 data center, the FBI's Northern Virginia Resident Agency, Virginia's State Forensics Lab, the Prince William Science Accelerator and the Level-3 GMU/NIH Biomedical Research Laboratory. That said, the majority of Innovation Technology Park remains undeveloped.[119] In 2019, GMUs Science and Technology campus has begun expansion plans to create a medical school at the Park (2022 targeted completion).[120]

Prior to establishing its Prince William campus, in 1979, GMU opened another satellite campus at Virginia Square, a more urban, metro accessible location in Arlington, Virginia. This facility, situated on 5.2 acres, was anchored by GMU's new law school. Subsequent expansion ensued, primarily dating back to 1999. Today, the campus accommodates the Schar School of Policy and Government, the Center for Regional Analysis, the graduate-level administrative offices for the School of Business, the School for Conflict Analysis and Resolution, the Mercatus Center, the Institute for Humane Studies and a 300-seat auditorium.[121]

In Fall 2019, GMU announced plans to expand this existing Arlington campus with $235 million in state funds (of which $125 million must be matched by GMU private donations) as part of the Tech Talent Investment Program to support Amazon's HQ2.[122]

Notable Features and Takeaways

- Existing northern Virginia locations facilitated local expansion in Arlington based on niche market / industry opportunities.
- Offering university-specialized and focused programs (i.e. at law school location) has contributed to more profound recognition and operational stability.
- Satellite facilities at closer-in established metro-accessible urban locations such as Arlington have fared better than more remote emergent suburban campuses.
- Tech courses will target computer science, computer engineering, information technology, cybersecurity engineering, information systems and computational and data science.

Georgia Institute of Technology (Atlanta) in Savannah, Georgia[123]

Atlanta-based Georgia Tech established a Savannah campus in 2003. The Savannah campus is a hub for professional and continuing education. It is home to the regional offices of the Georgia Tech Enterprise Innovation Institute, the Savannah Advanced Technology Development Center, and the Georgia Logistics Innovation Center. Programs represent an example of academic and hands-on, practical training in demand by industry (e.g. coastal region occupation safety and health focus). The program leverages its online Master of Science program to sustain significant enrollment growth.

Notable Features and Key Takeaways

- Current programs were recently revamped to specialize in local workforce needs since enrollment for duplicative courses vis-a-via the Atlanta campus had not met expectations.
- Reliance on technology to deliver programs has also bolstered enrollment.

New York University (New York) in Shanghai, China[124]

NYU in Shanghai represents China's first Sino-US research university and the third degree-granting campus of the NYU Global Network. Founded in 2012 via a partnership between New York University and East China Normal University with the support of the city of Shanghai and the district of Pudong. Curriculum offers five masters and eight PhD programs. Expansion overseas was based on mutual university interests targeting global presence implemented via a partnership.

Notable Features and Key Takeaways

- Common interests between universities.
- Unique program offering and broad-based partnership spin-offs (i.e. shared costs, facilitated implementation, etc.).

University of Southern California (Los Angeles) at Information Sciences Institute (ISI), Marina del Rey, California[125]

USC is based in Los Angeles along with its Viterbi School of Engineering. The Viterbi School of Engineering ranks as one of the leading (top 10) engineering schools in the county and was recently renamed following a major donation from the co-founder of Qualcomm.[126] The USC ISI is a university-affiliated computer research institute associated with the Viterbi School of Engineering. The USC ISI maintains its own physical space in three different locations separate from the main campus. USC ISI's primary facility is located in nearby Marina del Rey. USC ISI also maintains offices in Arlington, Virginia and Waltham, Massachusetts.

The USC ISI focuses on research and development in information processing, computing, and communications technologies and played a major role in the development of the internet. The USC ISI conducts basic and applied research supported by more than 20 U.S. government agencies involved in defense, science, health, homeland security, energy and other areas with annual funding of about $100 million. The USC ISI has approximately 350 employees, including professors and graduate students, spread amongst its three locations. It does not have an academic program but provides strategic researched-based opportunities for USC Viterbi School of Engineering students and faculty that support corporate product development. Private sector partnerships contribute to its funding and research sustainability (e.g. $3 million annually from Chevron Corp).

Notable Features and Key Takeaways

- Small research-only entity that is strategically located at multiple U.S. industry hubs.
- Partnerships with large established corporations.

Augments USC's industry and geographic branding.

11. Other Resources

The case study orientation of this analysis was informed by a variety of reference points, including interviews and literature reviews. Not surprisingly, there are an array of university / development partnership-based organizations and an extensive body of published material on the subject. Common themes from these resources are embodied in the case study commentary of this current report.

Representative Organizations

American Council on Education (ACE)

- https://www.higheredtoday.org/policy-research/campus-climate-inclusion/campus-climate-stem-success/ (Campus Climate and STEM Success, An ACE blog – Higher Education Today)
- https://www.higheredtoday.org/2017/03/15/deep-economic-development-partnerships-reshaping-universities-communities/ (Deep Economic Development: Partnerships That are Reshaping Universities and Their Communities, March 2017)

Association of American Universities (AAU, addresses key topics such as accreditation, higher education legislation, innovation and competitiveness, community impact, government-university partnership, technology transfer, etc.)

- https://www.aau.edu/key-issues/frequently-asked-questions-about-facilities-and-administrative-fa-costs-federally (Frequently Asked Questions about Facilities and Administrative (F&A) Costs of Federally Sponsored University Research, May 2017)
- https://www.aau.edu/key-issues/comparing-foundations-federal-government-research-support (Comparing Foundations to Federal Government Research Support, July 2017)
- https://www.aau.edu/sites/default/files/AAU%20Files/AAU%20Documents/Campaign-2012-Document-with-Appendix.pdf (Partnering for A Prosperous & Secure Future: The Federal Government and Research Universities, September 2012)
- https://www.aau.edu/key-issues/aau-fy20-funding-priorities-table (FY20 Federal Funding Priorities Table)

Association of Public and Land Grant Universities (Innovation and Economic Prosperity Universities Program, four case study examples below):

- https://www.aplu.org/projects-and-initiatives/economic-development-and-community-engagement/innovation-and-economic-prosperity-universities-designation-and-awards-program/IEP_Library/arizona-state-university-the-polytechnic-university/file (Arizona State University: The Polytechnic Campus, 2016)
- https://www.aplu.org/projects-and-initiatives/economic-development-and-community-engagement/innovation-and-economic-prosperity-universities-designation-and-awards-program/IEP_Library/colorado-state-university-energy-institute-at-the-powerhouse-energy-campus/file (Colorado State University: Energy Institute at the Powerhouse Energy Campus, 2016)

- https://www.aplu.org/projects-and-initiatives/economic-development-and-community-engagement/innovation-and-economic-prosperity-universities-designation-and-awards-program/IEP_Library/purdue-university-purdue-research-foundations-the-foundry-1/file (Purdue University: The Discovery Park and Drug Development, 2016)
- https://www.aplu.org/projects-and-initiatives/economic-development-and-community-engagement/innovation-and-economic-prosperity-universities-designation-and-awards-program/IEP_Library/montana-state-university-optical-technology-center-optec/file (Montana State University: Optical Technology Center, 2016)

Elsevier publishes the Journal of Research Policy and Journal of Economic Development

International Economic Development Council (IEDC)

- https://www.iedconline.org/book-store/economic-development-tools-and-trends/universities-and-colleges-as-economic-drivers/ (Universities and Colleges as Economic Drivers, 2012)

National Association of Branch Campus Administrators (NABCA, includes Access: The Journal of the NABCA)

- https://journals.iupui.edu/index.php/muj/article/view/20464/20064 (A Perspective on the Future of Branch Campuses, Vol 22. Metropolitan Branch Campuses, January 2011)
- https://journals.iupui.edu/index.php/muj/article/view/20460/20060 (Out on a Limb: The Precarious and Not so Precarious Existence of Branch Campuses, Vol 22. Metropolitan Branch Campuses, January 2011)

Organization for Economic Cooperation and Development (OECD, online library)

- https://www.oecd-ilibrary.org/science-and-technology/university-industry-collaboration_e9c1e648-en (University-Industry Collaboration, April 2010)

Policy Studies Organization (publishes the Policy Studies Journal)

- https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1541-0072.1998.tb01925.x (University‐Industry Collaboration on Technology Transfer: Views from the Ivory Tower, June 2005)

Technology Transfer Society publishes the Journal of Technology Transfer

University Economic Development Association (UEDA)

US Department of Commerce Economic Development Administration

- https://www.eda.gov/files/tools/research-reports/The_Innovative_and_Entrepreneurial_University_Report.pdf (The Innovative and Entrepreneurial University: Higher Education, Innovation & Entrepreneurship in Focus, October 2013)
- https://www.eda.gov/programs/university-centers/ (University Center Economic Development Program: Bringing Research to Work)

a. https://www.eda.gov/files/programs/university-centers/uc-tools/12-Georgia-Tech_UC.pdf (Georgia Tech Enterprise Innovation Institute)

- http://www.aspenwsi.org/wordpress/wp-content/uploads/CTWP-Playbook-Final-Nov-28-2016.pdf (Communities that Work Partnership Playbooks, November 2016)

Venture Well

- https://venturewell.org/industry-university-collaborations/ (Industry - University Collaborations, September 2019)
- https://www.linkedin.com/pulse/entrepreneurial-mindset-secret-ingredient-successful-dorn/ (Entrepreneurial Mindset: The Secret Ingredient to Successful Industry-University Partnerships, July 2018)

Client Discussed Supplemental Articles

Representative media resources featuring case study type discussions are provided below (select additional published material are listed in Appendix C):

Harvard, MIT, Alexandria Real Estate Equities, GE Plan Collaborative Biotech Center
Sperance, Cameron. (11/26/2019). Bisnow Boston.

Cross-Industry / Consortium Partnership Example – site TBD
Partners comprised of Harvard University, the Massachusetts Institute of Technology, Fujifilm Diosynth Biotechnologies, GE Healthcare Life Sciences and Alexandria Real Estate Equities are collaborating on a planned $50 million center of advanced biological innovation and manufacturing. The center will explore and cultivate innovations in cell and gene therapy, advance biological innovation and manufacturing and accelerate developments in immunotherapy, cell therapies, gene editing and other human health technologies. Other contributing members of the consortium include Bbeth Israel Deaconess Medical Center, Boston Children's Hospital, Brigham and Women's Hospital, the Dana-Farber Cancer Institute, Massachusetts General Hospital, MilliporeSigma and the Commonwealth of Massachusetts.

UC Berkeley Proposes Development of Moffett Field with NASA's Ames Research Center
Srinivasan, Meera. (8/16/2019). The Daily Californian.

University / Federal Partnership
UC Berkeley is exploring plans for a potential new venture with NASA's Ames Research Center that would develop a portion of Moffett Federal Airfield near Mountain View, CA, into a mixed research, education and housing site. In this venture NASA and Berkeley are building on an existing multi decade partnership anchored by the Lawrence Berkeley National Lab. Stated goals going forward are to expand the campus's physical and digital reach to serve students, advance discoveries and cultivate a global talent pool. The contemplated agreement is contingent of the university have flexibility to exit the agreement pending NASA's authority to issue a ground lease. The proposed site would need to be developed without taking away resources from core campus activities. Accordingly, underwriting the new partnership will require additional industry partners and third-party capital.

1871 Ranked as the Top University-Affiliated Incubators
Hustad, Karis. (11/4/2015). UBI Global report.

University-Affiliated Incubator Examples

- The DMZ at Ryerson University – Ryerson University; Canada
- 1871 – Northwestern University, University of Chicago, University of Illinois, Loyola University, Illinois Institute of Technology, DeVry University; United States
- Innovate Calgary – University of Calgary; Canada
- TEC Edmonton – University of Alberta; Canada
- Western Research Parks – Western University; Canada
- The Franklin Business Incubator – Paul D. Camp Community College; United States
- Lead To Win – Carleton University; Canada
- Ohio University Innovation Center – Ohio University; United States
- The Kevin M. McGovern Family Center for Venture Development in the Life Sciences – Cornell University; United States
- Venture Lab – Georgia Institute of Technology; United States

University Business Accelerators

- Entrepreneuriat Laval – Laval University; Canada
- MassChallenge – Boston University, Northeastern University, Worcester Polytechnic Institute; United States
- York Entrepreneurship Development Institute – York University, Schulich Executive Education Centre; Canada
- Launch Chapel Hill – University of North Carolina, Chapel Hill; United States
- The INKUBATOR – Northern Kentucky University; United States

University and Regional Economic Development: The Entrepreneurial University of Waterloo. Bramwell, Allison; and Wolfe, David A. (4/16/2008). ScienceDirect / Elsevier Research.

University Economic Impact

Knowledge transfers between universities and other economic actors are usually built on highly personal relationships, underscoring the significance of geographical proximity for the process of knowledge transfer. University of Waterloo's success at linking with industry is attributable to four well-known characteristics:

- the ability to attract, retain, and train top caliber graduates and researchers, and to link them with local and nonlocal employers;
- the provision of R&D support to local firms;
- the interactive exchange of tacit knowledge; and
- the active facilitation of entrepreneurial activities.

The Waterloo Co-Operative Education Program (Co-op) is of particular significance, facilitating the transfer of knowledge between students and industry, providing resources and information, and making the region attractive to entrepreneurs. The Co-op Program

consistently emerges as one of the key contributors to the quality of the talent pool in the Waterloo region. Locally hired students subsequently move on to other firms within the region, taking their specialized skills with them and providing a highly effective method of tacit knowledge transfer within the local cluster.

Additional Research University Themed Economic Development Studies

A broad set of academic analyses describe and validate the synergies between major research universities and regional economic development. Though not focused on the matter of attracting a new educational presence in local communities, there are some common themes illustrated in these studies that can help in proactively advancing university / local community economic development potential. Some highlights from the research papers listed below include:

- Transformative partnerships take time and patience and are not automatic. A note of caution is to recognize there is a propensity to overstate the magnitude of university contributions to an enhanced regional environment compared with other factors (i.e. government spending).

- Meaningful transfer of research (knowledge transfer) at the local level depends on there being a strong demand from user groups and effective conduits. This means that the university research base must complement existing local commercial conditions, specific to the needs of spin-offs. Moreover, universities need to be consciously engaged with both government and local business.

- Institutions need to apply different approaches for different industry group environments, suggesting the need for a thoughtful approach to local economies by institutions. For example, at the entrepreneurial level, local industry may be initially highly developed (i.e. MIT, facilitated by bottom-up university dissemination polices) or underdeveloped (i.e. Yale facilitated by top-down policies). Where more or less indigenous research / industry linkages have spawned, most notably in Boston and Silicon Valley, the results to seem to have occurred almost by spontaneous combustion. This is in contrast to where knowledge transfer hubs are trackable to deliberate, planned and coordinated economic development efforts, examples being North Carolina's Research Triangle Park, Atlanta's business cluster associated with Georgia Tech, and similar synergies noted around the University of Texas in Austin and University of California in San Diego.

- In addition to a strong basis of knowledge and ideas, spin-offs are more likely to commercialize where there is a supportive civic framework and multi-institutional collaborations, including having linkages to funding and management. Best practices for advancing effective partnerships include targeting specific areas of focus, leveraging core strengths, empowering visionary leadership, featuring a prominent corporate role, employing a catalyst organization, and securing sufficient funding to enable a long-term view.

- Despite the institutional commitment and resources that may be available, successful university / local economic synergies depend on policies that are informed by the unique features of industrial sectors and how they operate in particular places.

Summarized literature includes:

1. Low, Mark; and Sudow, Tom. (Spring 2015). *The Global Cardiovascular Innovation Center.* Economic Development Journal, Vol 15 No 2.
2. Epstien, Jeff. (Spring 2015). *Cleveland Health-Tech Corridor.* Economic Development Journal, Vol 15 No 2.
3. Hayter, Christopher S. (1/2/2013). *Harnessing University Entrepreneurship for Economic Growth: Factors of Success Among University Spin-Offs.* Economic Development Quarterly, Vol 27(1) pages 18-28.
4. Audretsch, David B.; Leyden, Dennis P; and Link, Albert N. (2013). *Regional Appropriation of University-Based Knowledge and Technology for Economic Development.* Economic Development Quarterly, Vol 27, pages 56-61.
5. Breznitz, Shiri M.; and Feldman, Maryann P. (7/17/2010). *The Engaged University.* Journal of Technology Transfer (2012) 37:139-157.
6. Youtie, Jan; and Shapira Philip. (6/4/2008). *Building an Innovation Hub: A Case Study of the Transformation of University Roles in Regional Technological and Economic Development.* ScienceDirect / Elsevier Research.
7. Breznitz, Shiri M; O'Shea, Rory P.; and Allen, Thomas J. (2008). *University Commercialization Strategies in the Development of Regional Bioclusters.* Journal of Product Innovation Management, Vol 25: 129-142.
8. Smilor, Raymont; O'Donnell, Niall; Stein, Gregory; and Welborn III, Robert S. (8/2007). *The Research University and The Development of High-Technology Centers in the United States.* Economic Development Quarterly, Vol 24 No 3, pages 203-222.
9. Smith, Helen Lawton. (2/1/2007). *Universities, Innovation, and Territorial Development: A Review of the Evidence.* Environmental and Planning C Journal: Politics and Space; Volume 25, pages 98-114.
10. Bercovitz, Janet; Feldmann, Maryann. (2006). *Entrepreneurial Universities and Technology Transfer: A Conceptual Framework for Understanding Knowledge-Based Economic Development.* Journal of Technology Transfer, 31: 175-188.

Appendix A
M-NCPPC Research University Case Study Analysis
Universal Case Study List

#	University	INITIAL CRITERIA		ADDITIONAL EVALUATION CRITERIA				INFORMATION
		Satellite Campus (Y/N/MC)	Graduate + Level Curriculum	Major MSA with Suburban Locations	Program Not Exclusively Instructional	Partnerships / R&D Funding / Incubator	Outside State of Main Campus	Recognized R&D $ Institutions (NSF = 2017; NIH = 2019)
Primary Case Studies								
1	Carnegie Mellon Univ @ Mountain View, CA	Yes	Yes	Yes	Yes	P (NASA) / I	Yes	NSF: 71
2	Indiana Univ - Purdue Univ @ Indianapolis, IN	MC	Yes	Yes	Yes	R&D	No	NSF: 188
3	Texas Med School @ Houston, TX	Yes	Yes	Yes	Yes	R&D	No	NSF: 92
4	Virginia Tech University @ Arlington, VA	Yes	Yes	Yes	Yes	P / R&D / I	No	NSF: 46
Secondary Case Studies								
1	AZ State Univ Polytechnic Campus @ Mesa, AZ	MC	Yes	No	Yes	P / R&D / I	No	NSF: 44
2	Cornell Tech in NYC							
3	University of Michigan @ Detroit, MI	MC	Yes	Yes	Yes	R&D / I	No	NSF: 2; 578 | NIH: 2
4	Scripps Research Institute @ Jupiter, FL	Yes	Yes	Yes	Yes	R&D	Yes	NSF: 67 | NIH: 47
Other Case Study Lessons Learned								
1	University of Chicago @ London & Hong Kong	Yes	Yes	Yes	Yes	P / R&D	Yes	NSF: 55
2	Colorado State Global Campus	Yes	Yes	No	No	No	Digital	No
3	George Mason Univ @ Prince William County, VA	MC	Yes	Yes	Yes	P / R&D / I	No	NSF: 146
4	Georgia Institute of Technology @ Savannah, GA	Yes	Yes	Yes	Yes	P / R&D / I	No	NSF: 24
5	New York University @ Shanghai, China	Yes	Yes	Yes	Yes	R&D / I	Yes	NSF: 18 | NIH: 25
6	Univ of S Calif @ Info Sciences Institute, LA, CA	Yes	Yes	Yes	Yes	P /R&D / I	No	NSF: 27 | NIH: 21
Considered Example Case Studies								
1	Univ of Melbourne @ Shepparton, Australia	Yes	Yes	Yes	Yes	R&D / I	No	No
2	NW Univ @ Feinburg School of Med (Chicago)	Yes	Yes	Yes	Yes	R&D	No	NSF: 29 | NIH: 28
3	University of Washington @ Bothell, WA	Yes	Yes	Yes	Yes	R&D / I	No	NSF: 5 | NIH: 11
4	University of Colorado @ Denver, CO	MC	Yes	Yes	Yes	P / R&D / I	No	NSF: 48
5	Columbia University @ Manhattanville, NYC	Yes	Yes	Yes	Yes	R&D / I	No	NSF: 20 | NIH: 12
6	Baylor College of Medicine @ Houston, TX	MC	Yes	Yes	Yes	P / R&D / I	No	NSF: 39 | NIH: 29
7	University of California @ San Francisco, CA	MC	Yes	Yes	Yes	P / R&D / I	No	NSF: 3 | NIH: 6
8	University of Texas @ Austin. TX	MC	Yes	Yes	Yes	P / R&D	No	NSF: 35
9	Texas A&M University @ Galveston, TX	Yes	Yes	Yes	Yes	R&D	No	NSF: 19
10	Purdue University @ West Lafayette	MC	Yes	No	Yes	P / R&D	No	NSF: 37
11	University of Pittsburgh @ Bradford	Yes	Yes	No	Yes	R&D	No	NSF: 16; 743 | NIH: 4
12	Penn State University @ Erie	Yes	Yes	No	Yes	P / R&D / I	No	NSF: 23
13	Idaho State University @ Meridian	Yes	Yes	No	Yes	R&D	No	NSF: 274
14	University of Michigan @ Flint	MC	Yes	No	Yes	R&D / I	No	NSF: 2; 578 | NIH: 2
15	Harvard University @ Villa I Tatti (Italy)	Yes	No	No	Research only	P / R&D / I	Yes	NSF: 9 | NIH: 37
16	Princeton University	Yes	Yes	No	Yes	P / R&D	Yes	NSF: 72
17	Syracuse University	Yes	Yes	No	No	P / R&D	Yes	No
18	University of Waterloo (Canada)	Yes	Yes	No	Yes	P / R&D	No	No
19	Mayo Clinic Grad School (Rochester)	MC	Yes	No	Yes	P	Yes	No
20	Vanderbilt University	No	Yes	Yes	Yes	R&D / I	N/A	NSF: 31 | NIH: 24
21	Rice University	No	Yes	Yes	Yes	R&D / I	N/A	NSF: 126
22	Case Western Reserve	No	Yes	Yes	Yes	P / R&D / I	N/A	NSF: 58| NIH: 43
23	Weizmann Institute of Science	No	Yes	N/A	Yes	R&D	N/A	No
24	University of California @ San Diego	No	No	Yes	No	N/A	No	NSF: 7 | NIH: 8
25	University of California @ Los Angeles	No	Yes	Yes	Yes	R&D / I	No	NSF: 12 | NIH: 10
26	University of Wisconsin @ Madison	No	Yes	Yes	Yes	P / R&D / I	No	NSF: 6 | NIH: 23
27	Duke University	No	Yes	Yes	Yes	P / R&D / I	No	NSF: 8 | NIH: 16
28	University of North Carolina at Chapel Hill	No	Yes	Yes	Yes	R&D / I	No	NSF: 11 | NIH: 14
29	University of Minnesota @ Twin Cities	No	Yes	Yes	Yes	P / R&D / I	No	NSF: 17 | NIH: 22
30	University of Pennsylvania	No	Yes	Yes	Yes	P / R&D / I	No	NSF: 4 | NIH: 5
31	Massachusetts Institute of Technology	No	Yes	Yes	Yes	P / R&D / I	No	NSF: 14
32	California Institute of Technology	No	Yes	Yes	Yes	P / R&D	No	NSF: 60
33	Rockefeller University	No	Yes	Yes	Yes	R&D	No	NSF: 74
34	Brown University	No	Yes	Yes	N/A	P	No	No
35	Dartmouth College	No	Yes	No	Yes	P	No	NSF: 76
36	Emory University	No	Yes	Yes	Yes	R&D	No	NSF: 34 | NIH: 19
37	University of Illinois @ Urbana - Champaign	No	Yes	No	Yes	R&D / I	No	NSF: 36
38	University of Cambridge (UK)	No	Yes	No	Yes	P / R&D	No	No
39	Oxford University (UK)	No	Yes	No	No	P / R&D	No	No
40	University of Toronto (Canada)	No	Yes	No	Yes	P / R&D / I	No	No
41	University of Edinburgh (Scotland)	No	Yes	Yes	Yes	P / R&D	No	No
42	Stanford University	Yes	No	Yes	Admin only	P (City) / I	No	NSF: 10 | NIH: 7
43	Max Planck @ Florida Atlantic University	Yes	No	Yes	Yes	P / R&D	No	NSF: 202
44	Berkeley @ Livermore Lab & Moffett Field	Yes	No	Yes	Research only	P / R&D	No	NSF: 26
45	Washington University @ St. Louis	Yes	No	Yes	N/A	R&D	No	NSF: 28 | NIH: 3
46	Yale University	Yes	No	N/A	Yes	R&D	Yes	NSF: 15 | NIH: 13
47	Emerson College	Yes	No	Yes	Yes	No	Yes	No
48	Tufts European Center	Yes	No	No	No	No	Yes	NSF: 100

Sources: M-NCPPC, Bolan Smart, Alvarez & Marsal, National Science Foundation, NIH, US News and World Report Best Colleges, 11/2019

Appendix B
M-NCPPC Research University Case Study Analysis

PLANNING STORY

Breaking the Mold

Cornell Tech and the 21st-Century University

by Steven Jacobs, Karen Backus, Gilbert Delgado, and Colin Koop

How does a university develop a vision for a campus dedicated to fields that are largely defined by exponential change?

IN LATE 2010, NEW YORK CITY MAYOR Michael Bloomberg announced one of the most novel and aspirational initiatives of his mayoralty: the City of New York would try to attract a top-ranked applied sciences university to establish a new, from-the-ground-up campus at one of several city-owned sites. In addition to offering an extremely valuable commodity—free public land in New York City—the Bloomberg administration was also prepared to offer up to $100 million in capital subsidies.

Exactly one year after the launch of this initiative, the city selected Cornell University and its partner, the Technion–Israel Institute of Technology, to develop a new applied sciences campus on Roosevelt Island. With no time to rest on their laurels, the winners of this competition immediately began to turn their vision for Cornell Tech into reality, creating a truly 21st-century urban university—a graduate-only institution wholly dedicated to technology commercialization and entrepreneurship in fields and forms that fit the economic strengths and needs of New York City. To meet the project's ambitious objectives, Cornell would have to break the mold and pursue an approach never before seen in American higher education.

PROPELLING NEW YORK CITY TO TECH PREEMINENCE

Why did New York City, one of the world's most global and energetic metropolises, feel the need to woo out-of-town universities with free land and money? Part of the answer can be found in the wake of the 2008 financial crisis. The crisis hit the finance sector hard at a time when the city's economy was still very dependent on Wall Street.

The Bloomberg administration saw the potential for the tech sector to help diversify the city's economy, yet there were a number of challenges to overcome. While New York City already boasted several academic institutions with excellent programs in engineering and the applied sciences, none ranked in the top 10 nationally. And, despite the presence of Google's east coast headquarters and a roster of successful tech start-ups, New York lagged far behind Boston and the San Francisco Bay Area as a major hub for tech companies and tech talent.

In meeting after meeting held by New York City Economic Development Corporation officials with local industry heads and thought leaders, a theme emerged: to grow New York's tech economy, the city would need many more engineers and computer scientists than it was presently producing—and it would need to keep them in New York by embedding them in the city's leading industries of finance, media, advertising, entertainment, and health care. The idea of a new, top-flight research university with a focus on engineering and the applied sciences that would transform New York City into a tech center of global preeminence began to take shape.

CORNELL'S UNPARALLELED OPPORTUNITY

In December 2010, the city issued a Request for Expressions of Interest to leading universities around the world and offered five city-owned sites for the project. The city received an astonishing 18 responses from 27 institutions both foreign and domestic; among those respondents was Cornell University. For Cornell, a private Ivy League institution and New York's land-grant university, an expanded presence in New York City was an already-established institutional goal. While Cornell's medical school and some smaller programs are located in Manhattan, the university's main campus is in the city of Ithaca in a largely rural region of central New York State that is four hours by car from New York City. Ithaca and its surrounding county together have a population of only 101,000 with no nearby large cities and relatively few transportation links.

Though Cornell's engineering school ranked in the top 10, its relative remoteness hindered both industry partnerships and recruitment of top talent. Cornell's leadership saw that a strong foothold in New York City would allow the university to more fully access and leverage the city's assets while also enhancing its land-grant mission to serve all of New York State. Further, the Bloomberg administration's offer of land and capital presented an attractive opportunity to accelerate Cornell's existing efforts to expand in New York City.

ORGANIZING AN INSTITUTION

From the start, Cornell's approach to responding to New York City's solicitation was top-to-bottom engagement, with full commitment from then university president David Skorton and the Board of Trustees. Then university provost W. Kent Fuchs led a working team comprising the deans of the College of Engineering, the faculty of the Departments of Computer Science and Information Science, and a senior administrator from the College of Engineering, supported by staff from numerous departments. This team worked closely with four faculty committees charged with developing an interdisciplinary core program designed to address changing pedagogical needs in the applied sciences. This nascent core program would serve as the framework for the academic vision of Cornell Tech.

In addition to support from university leadership and faculty, Cornell marshaled the support of its student body and alumni, many of whom were tech industry leaders in New York City, Boston, and Silicon Valley. A viral petition supporting Cornell's response to New York City's solicitation garnered over 20,000 signatures.

To serve as project manager, Cornell's leadership engaged U3 Advisors (formerly K. Backus & Associates), a New York City-based real estate consulting firm that specializes in strategic planning and development for universities and other nonprofit clients. U3 Advisors would assist Cornell with crafting its vision, identifying appropriate team members, and managing the multiple streams of work that would be required to respond effectively to the Bloomberg administration's solicitation. Cornell also hired Skidmore Owings & Merrill as its master planner in addition to procuring land use counsel, a lobbyist, and a public relations consultant.

BUILDING A NEW VISION FOR AN APPLIED SCIENCES CAMPUS

How does a university develop a vision for a campus dedicated to fields that are largely defined by exponential change? Daniel Huttenlocher, the founding dean of Cornell Tech and former dean of computing and information science in Ithaca, noted that Cornell Tech is "the first graduate research institution where someone is trying to design it from the ground up in the information age.... That is a very abstract goal and, frankly we don't understand the consequences of trying to design something for a new age right now" (Nir 2012, ¶ 7–8).

In developing a response to New York City's Request for Expressions of Interest, Cornell's leadership expanded and refined ideas they had already been considering concerning the development of a new university model for the applied sciences. A key consideration for Cornell, which also aligned closely with the objectives of the Bloomberg administration, was the creation of an academic culture that nurtures local start-ups and job creation—as opposed to the more traditional corporate sponsorship model that, while financially attractive, can siphon off innovation and jobs. Cornell did not wish to replicate existing peer models in which substantial multi-year corporate investments in joint research projects are sought in exchange for the right to use applications licensed by the university. Cornell saw from experience that this approach, while getting research funded, often tends to choke off start-ups and move jobs and other benefits of intellectual property to existing corporate sponsors, who are often not local.

Cornell instead envisioned a campus that promoted a different kind of commercial partnership—multidimensional, focused on students, and spanning all stages of business growth. Under this model, Cornell could position itself as the focal point of the growing tech ecosystem in New York City by seeking commercial partnerships in which dynamic companies could work directly with Cornell students, those companies' employees could work in Cornell labs, and Cornell researchers could pursue applied research topics of mutual interest. Both Cornell and New York City would benefit as the university could more effectively give its graduates and faculty the tools they needed to start their own companies and the incentive to stay close to home.

HUB-BASED MODEL

In developing this new model, it is important to note that early on Cornell rejected the idea of traditional academic departments and instead envisioned a campus that would be organized around interdisciplinary "hubs" designed to put technology and enterprise on an equal footing—and to engage the multiple disciplines that are essential to connecting cutting-edge education and research to real-world impact. The hubs were designed to draw on the core technical disciplines of computer science, electrical « engineering, information science, and operations research and to leverage the specific strengths of the New York City economy.

Cornell envisioned a campus that would be organized around interdisciplinary 'hubs' designed to put technology and enterprise on an equal footing.

As such, the hubs would also draw on a broad range of other disciplines, including business, communications, design, economics, and public health, that are critical to technology-driven innovation.

Cornell proposed three initial hubs: (1) Connective Media, which would help New York City bridge the gap between technology and its uses in such industries as advertising, entertainment, finance, publishing, and retail; (2) Healthier Life, which would promote research focusing on technologies to drive down health care costs or improve the quality of health care services; and (3) Built Environment, in which faculty and students would use research and technology in architecture, construction, energy, and transportation to help realize the promise of a more sustainable environment. The hubs would be dynamic, evolving as needed to keep abreast of rapidly changing trends in both technology and markets.

DEVELOPING A COMPETITIVE STRATEGY

Cornell submitted its response to New York City's Request for Expressions of Interest in the spring of 2011, outlining its vision and framework for the three interdisciplinary hubs, providing high-level architecture and design plans, and stating interest in three potential city-owned sites: Roosevelt Island, Governors Island, and Downtown Brooklyn. Cornell initially proposed a project of only 650,000 square feet.

Soon after, the Bloomberg administration informed Cornell that, along with over 20 other leading academic institutions from around the world, it was now invited to respond to a much more far-reaching Request for Proposals. In addition to a fuller outline of the proposed academic program, the RFP would require Cornell to identify a site and provide a master plan, a phasing plan, and a detailed financial analysis that included sources and uses of funds for both Phase I and the full build-out along with operating budget projections. Perhaps most importantly, all respondents would be required to develop a concrete approach to building the innovation economy in New York City through company start-ups, industry partnerships, and a general culture of entrepreneurship.

Cornell had several advantages over its competitors. As a New York State-based institution, it had over 50,000 alumni living in the New York City metropolitan area, and its alumni and trustees were well represented among the city's business, civic, and cultural leaders. In addition, with large capital projects at Weill Cornell Medical College, the university had already demonstrated a strong development track record in New York City and could assemble a team of outside professionals with deep experience in negotiating with the City of New York and the New York City Economic Development Corporation. Further, because of its existing presence in New York City, Cornell would be able to commence classes in temporary facilities in Manhattan within a year of being chosen, giving it an important head start in delivering on the city's goals.

However, when compared to some of its competitors—most notably, Stanford University—Cornell had some significant disadvantages. While over 2,600 Cornell-related companies had been established since 2006, the university's relatively remote location in upstate New York put it at a disadvantage vis-à-vis its California peer and the latter's well-documented role in catalyzing Silicon Valley. To address this perceived weakness, Cornell's leadership reached out to the Technion–Israel Institute of Technology, the most prestigious applied sciences university in Israel and the engine behind that country's much vaunted evolution from agricultural economy to "start-up nation." Today, the Technion, which is based in Haifa, is responsible for half the Israeli companies on NASDAQ.

As a foreign public institution, Technion is not permitted to invest in capital projects on the new campus or take an ownership stake in physical facilities. However, Technion joined with Cornell in committing to a strong academic partnership that, based on both institutions' track records, would ensure an innovative, interdisciplinary academic program with direct pathways to business formation and job creation. Technion and Cornell will issue joint degrees and jointly select and fund faculty positions within the Jacobs Technion-Cornell Institute at Cornell Tech.

Early in the process, Cornell also decided that its proposed campus in New York City would adopt a design strategy that physically manifested its commitment to innovation and environmental sustainability: its flagship academic building would be "net zero," meaning that the total amount of energy used by the building on an annual basis would be equal to the amount of renewable energy created on-site. This would be achieved primarily through photovoltaic panels and on-site geothermal wells.

Finally, Cornell was able to leverage its vision—and counterbalance Stanford's far superior financial capacity—by securing a $350 million gift from a Cornell alumnus, Charles Feeney, through his foundation Atlantic Philanthropies. This gift would be dedicated to funding the full cost of implementing the first phase of campus development, putting Cornell in a financial position that few competing universities could match.

REFINING THE VISION: THE PHYSICAL CAMPUS

Initially, Cornell had considered three city-owned sites for its new campus, but by the time it developed its response to the Bloomberg administration's Request for Proposals, the university had clearly determined that the site on Roosevelt Island was the most desirable. As the only city-owned site with excellent subway access, this 12.5-acre parcel on the southern portion of a narrow, densely populated island in the East River between Manhattan and Queens was seen as the best option for accommodating Cornell's research and teaching needs while fostering its commercial partnership mission (figure 1). The site, which was occupied by a city-owned hospital scheduled for decommission, provides quick and easy access to Manhattan and the East Side research medical corridor and is adjacent to the increasingly lively commercial centers of Long Island City and Western Queens—neighborhoods that Cornell viewed as integral to accommodating the space needs of companies incubated at the tech campus.

While the site required rezoning and other discretionary land use approvals, Cornell elected to pursue a special district approach that would provide it with enormous future flexibility—and the ability to accommodate up to 2.1 million square feet of floor area. Of this, Cornell would devote an estimated 700,000 square feet to its academic program, leaving 1.4 million square feet for housing, an executive education center and hotel, and commercial space to accommodate tech companies, both large and small, seeking to co-locate with the research going on at Cornell Tech (figure 2). Together, these components would define an urban campus community connected to a vibrant and growing commercial technology sector.

Figure 1 **Cornell Tech Context Plan**

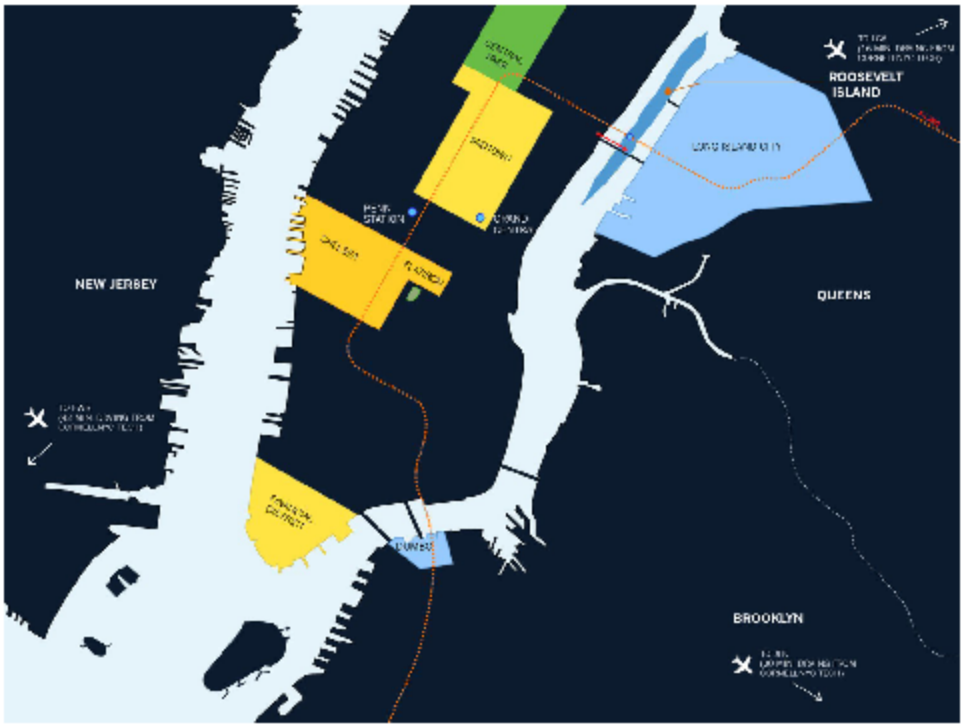


Figure 2 **Cornell Tech Full Build Site Plan**

MASTER PLAN

In developing a master plan for the Cornell Tech campus, the university and Skidmore Owings & Merrill (SOM) sought a design that promoted both connectivity and sustainability while making a striking visual statement (figures 3 and 4). Cornell and SOM believed that an institution dedicated to technology and enterprise must be unusually open, externally as well as internally, encouraging its constituents to reach out not only across academic boundaries but also beyond the campus perimeter. The campus therefore was designed to promote collaborative connectivity and flexibility, assuring that academic, research, and commercialization spaces would exist side by side with porous boundaries in between. As described by Dean Huttenlocher, Cornell's objective is "an environment with constant interaction ... this is a very important piece of the culture we're trying to create" (Pérez-Peña 2013, ¶ 18).

Figure 3 **Cornell Tech Aerial View (1)**

Figure 4 **Cornell Tech Aerial View (2)**

To advance these goals, SOM adopted six key design concepts to serve as planning principles for the campus master plan:

1. RIVER-TO-RIVER CAMPUS. Located on a narrow island between two channels of the East River, the campus will engage the riverfront esplanades on both its east and west perimeters and promote visual and physical connectivity.
2. DIVERSE COLLECTION OF OPEN SPACES. Anticipating that interior spaces in campus buildings will be open and collaborative workplaces, the design of exterior open spaces on campus will mirror this approach with "outdoor rooms," amphitheaters, lawns, and esplanades to create a sense of openness and accessible connections. In addition, over 500,000 square feet of outdoor space on the campus will be open to the public, creating a place where everyone is welcome to come together for lectures, sporting events, concerts, and other events—or simply to relax and enjoy the views.
3. RELATIONSHIP BETWEEN INDOOR AND OUTDOOR SPACES. Interior ground-floor spaces in each of the campus's diverse buildings will spill out onto the exterior public spaces in a manner that promotes casual interaction and encourages continuous dialogue among students, faculty, and commercial partners.
4. NORTH-SOUTH PEDESTRIAN SPINE. A physical pathway that meanders from the north perimeter to the south perimeter of the campus will serve as both a connective channel and an organizing element. The pedestrian spine will also link each of the campus's outdoor "rooms" and public gathering spaces, which are designed to be a destination and meeting ground for the entrepreneurs, scientists, and businesses that will make up the Cornell Tech community.
5. BUILDINGS OPTIMIZED FOR USE AND PERFORMANCE. Buildings on the Cornell Tech campus will be designed to stimulate interaction and the free flow of information. Features should include open interior spaces and programmed exterior rooms that are connected, reconfigurable for optimal use, and designed around idea creation.
6. A LIVABLE AND SUSTAINABLE CAMPUS. The master plan for the Cornell Tech campus will incorporate state-of-the-art elements that promote sustainable design with minimal environmental impact. Beyond its plan to develop the first academic building as one of the country's largest net-zero energy structures, Cornell envisioned the tech campus as a living laboratory of sustainability, much of it guided by expertise from Cornell's Ithaca campus, where faculty and students continuously explore and implement solutions to sustainability challenges in the built environment. Consistent with this principle, Cornell also pursued cutting-edge "passive house" technology for the 250,000-square-foot residence building for students, faculty, and staff.

Importantly, Cornell committed to adhering to each of these principles through all phases of construction, promoting the concept of a "complete campus" from day one.

PRIVATE ENTERPRISE AND THIRD-PARTY DEVELOPMENT

The involvement of private enterprise on the Cornell Tech campus was always a foregone conclusion as the integration of business and entrepreneurship into degree-granting programs is a fundamental element of the project's vision. In developing a new model for the 21st-century university in which nontraditional commercial facilities such as corporate co-location offices, incubators, demo space, and ancillary retail are key, third-party development partners play an integral role. Of the almost 800,000 square feet of facilities to be built in the campus's first phase, nearly 75 percent will be owned in whole or in part by third-party developers.

In part, this development structure was born out of necessity; Cornell had identified a need for 700,000 square feet of academic space on a site that could accommodate over two million square feet. While this provided a tremendous opportunity to develop the types of ancillary facilities that would serve the campus's larger mission, Cornell neither had the financial resources to undertake such a massive project on its own nor was such development a core strength of the university. By relying on third-party developers, Cornell could develop the vibrant multi-use Phase I campus it sought while preserving its resources and minimizing the impact on its balance sheet.

The decision to pursue private partners and leverage outside capital was therefore an early one for Cornell. The Phase I program includes an academic building, executive education center, corporate co-location building, and residential building; of these facilities, only the first two will be wholly owned by the university (box 1). Following its selection by the city, Cornell tested market interest in the non-academic buildings by issuing Requests for Expressions of Interest to targeted developers; market interest was substantial, and the RFEIs were followed by more comprehensive Requests for Proposals for a master developer and residential developer.

THIRD-PARTY DEVELOPMENT: CHALLENGES AND OUTCOMES

Cornell settled on a hybrid development approach, selecting New York City-based Forest City Ratner Companies as master developer for the entire campus and developer/owner of the corporate co-location building. Forest City Ratner will also develop Cornell's first academic building on a fee basis. While Cornell originally intended for the residential building to be developed and owned by a private developer as well, it ultimately decided to co-invest and enter into a joint venture with the New York City-based developers Hudson Companies and Related Companies. Cornell will develop the executive education center and seek a developer for the hotel component in a future phase.

In pursuing these third-party development partnerships, Cornell encountered a number of challenges that arose from the start-up nature of the project and the unproven market of Roosevelt Island. Despite the site's proximity to Midtown Manhattan, Roosevelt Island had always been primarily residential and slightly isolated by its geography; it had no history of commercial development that could provide a leasing track record or rent comparables for lenders. In addition, while locations outside the central business district, primarily in the boroughs outside Manhattan, often come with city-granted tax abatements, no such abatements were available on Roosevelt Island, which is technically part of the Borough of Manhattan. Finally, the target tenants for the corporate co-location building were smaller tech companies that were likely not creditworthy, presenting additional challenges in securing financing.

As a result, Cornell found that free land and "ready-to-go" sites were not enough to attract private development to such a pioneering project. Tax relief from the city, similar to the abatements offered at other non-core locations, would be essential. In addition, developers would not be able to contribute their pro-rata share of development costs and still receive a reasonable return. Cornell, therefore, had to provide additional subsidies to leverage developer investment, including contributing site development costs as "patient" equity, leasing back one-third of the space at the corporate co-location building to give the developer a credit lease, and providing a limited pledge to cover the gap between actual commercial rents and the rents needed to yield the developer's required return (box 2). While these subsidies were not originally intended, Cornell structured them so that they optimally addressed the university's needs, limited its exposure, set clear limits, and provided long-term return on its investment capital. In addition, Cornell ensured its participation in net operating income and proceeds from capital events, such as sale or refinancing. In the case of the residential building, financing challenges arose due to uncertainties surrounding the "start-up" nature of the new

Box 1 **Overview of Phase I Buildings**

Third Party Development: Overview of Phase I Buildings

Academic Building

- Owned by Cornell
- Developed on fee basis by Forest City
- 150,000 SF

Corporate Co-Location Building

- Owned and developed by Forest City
- 242,000 SF commercial office building Cornell will lease 1/3 for academic space

Residential Building

- Owned by JV of Cornell and developer; developed by JV of the Hudson Companies and the Related Companies
- 256,000 SF apartment building for graduate students, post-doctoral candidates, faculty and staff

Executive Education Center

- 44,000 SF state-of-the-art executive education center to be owned and funded by Cornell
- In discussions with developer for 150–200-room hotel

Box 2 **Third-Party Development: Corporate Co-Location Building Case Study**

Third Party Development: Corporate Co-Location
Building Case Study

Challenges

- Unproven location on Roosevelt Island
- No rent comparables
- No as-of-right tax abatement vs. other outer borough locations
- Target tenants not creditworthy
- How to finance?

Outcomes

- Contribution of Cornell land and site development cost as patient equity
- Cornell space lease
- "Gap rent" deal for spec space
- Tax abatement
- Cornell receives return of invested capital and shares in upside

Box 3 **Third-Party Development: Residential Building Case Study**

Third Party Development
Residential Building Case Study

Residential Building

- Innovative building to express essence of campus
  - Mixing of students and faculty
  - Experimental "micro units"
  - Sustainability aspirations

- Also a challenge to finance due to "start-up" campus and need for affordable rents
- Cornell decision to co-invest its lower-cost capital and share in upside
- Project should make money for Cornell

campus and Cornell's need for rents that would be affordable for graduate students and faculty. In this instance, Cornell elected to use its lower-cost capital to co-invest with the developer while preserving its ability to receive a return on capital and participate in any future financial upside (box 3).

PROJECT IMPLEMENTATION AND CURRENT STATUS

Mayor Bloomberg announced the city's designation of Cornell at a press conference held at Weill Cornell Medical College in Manhattan just before the Christmas holidays in 2011. The Bloomberg administration, however, would take no chances that its signature project would be delayed or derailed: as part of this designation, Cornell and the city executed a pre-development agreement that committed the university to a strict schedule of performance milestones. These would ensure closing of title by the end of Bloomberg's term in 2013 and commencement of construction by January 2015. Moreover, the campus's first phase would have to open in 2017 with a minimum of 300,000 square feet of facilities and required numbers of graduate students and faculty. Failure to meet any milestone—including interim steps, such as completion of an Environmental Impact Statement—would result in significant financial penalties and, ultimately, default.

Immediately following its designation, Cornell moved quickly to begin the city's arduous environmental review and land use approval process, including the disposition of city property, rezoning, and mapping of new streets. In January 2013, Cornell Tech welcomed its inaugural class of graduate students in temporary facilities donated by Google. Cornell successfully secured all of its land use approvals in the spring of 2013. Closing on the land followed in December, and Cornell began abatement efforts and demolition of the buildings on the project site in early 2014. Construction of Cornell Tech began in earnest in early 2015.

In June 2015, against a backdrop of cranes and heavy construction equipment, Cornell held a ceremony on Roosevelt Island to thank the many elected officials, donors, university leaders, and supporters who helped make the campus a reality. Former Mayor Bloomberg announced a $100 million gift for Cornell Tech's first academic building, which will now be known as the Bloomberg Center. Just weeks earlier, Cornell Tech's third class of computer science students and first class of Johnson Cornell Tech MBAs received their diplomas. A Phase I campus, comprising nearly 800,000 square feet of academic, corporate co-location, residential, and executive education facilities, is on schedule to open for the 2017–18 academic year with approximately 400 graduate students enrolled. Per Cornell's agreement with the City of New York, a second phase of additional academic, corporate co-location, and residential buildings will be completed in the 10 years following the opening of the Phase I campus. By 2037, the campus is expected to grow to its full 2.1 million square feet and enroll 2,500 graduate students.

Already, Cornell Tech has forged a pioneering path in applied sciences education. A traditional, highly academic approach to pedagogy has been discarded, and the wall between academia and real-world technology has been forcefully demolished. The Connective Media and Health Tech master's programs have been launched with another hub on the way. Technology leaders from Silicon Valley are frequent visitors to Cornell Tech's temporary campus, and the former chief technology officer of Twitter, a Cornell alumnus, has been ensconced as Cornell Tech's chief entrepreneurial officer, organizing weekly practicums with start-up founders. In the first such arrangement with any academic institution, the U.S. Department of Commerce has permanently stationed a patent officer on campus to help university and community alike secure patents and licenses.

A traditional, highly academic approach to pedagogy has been discarded, and the wall between academia and real-world technology has been forcefully demolished.

As innovative programs continue to emerge at Cornell Tech's temporary facilities in Manhattan and campus buildings begin to rise on the southern end of Roosevelt Island, the original vision of a transformative initiative in the applied sciences for New York City is most definitely being realized. In the end, it was a successful collaboration between the city, the university, and the developers, each offering mutual concessions in the service of a shared, far-sighted vision, that brought Cornell Tech to fruition.

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M-NCPPC Research University Case Study Analysis
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