

## “Putting Innovation in Place: Georgia Tech’s Innovation Neighbourhood of ‘Tech Square’”

Greg Giuffrida, Jennifer J. Clark, Stephen E. Cross

Georgia Institute of Technology, Atlanta, Georgia, United States of America

[ggiuffrida@gatech.edu](mailto:ggiuffrida@gatech.edu)

[jennifer.clark@gatech.edu](mailto:jennifer.clark@gatech.edu)

[cross@gatech.edu](mailto:cross@gatech.edu)

**Abstract:** Discussions of university-based economic development practice have evolved from discrete discussions about constituent elements (ex. technology transfer, firm start-ups, etc...) to more integrated discussions about the role of the entrepreneurial university in shaping innovation districts. Policy analysts have identified “innovation ecosystems” connected to anchor institutions in Baltimore, Buffalo, Cambridge, Cleveland, Detroit, Houston, Philadelphia, Pittsburgh, St. Louis, San Diego, and “Tech Square” in Atlanta. These innovation districts share characteristics in common with the “Triple Helix” thesis combining university, industry, and government partners to build innovation neighborhoods connected to anchor institutions. Although the success of these innovation districts has been widely noted, the elements underlying that success have not been systematically identified. This study contributes to this evolving scholarship by examining the development and evolution of Technology Square in Atlanta, Georgia, USA.

The “triple-helix” thesis articulated by Etzkowitz and Leydesdorff argues successful innovation cultures are fostered by continuous and iterative interaction among universities, governments, and industry. The Brookings Institution’s innovation districts model further considers the physical space and relationship culture in which these triple helix interactions manifest: 1) Economic assets (the triple-helix actors); 2) Physical assets (public and private space, infrastructure, and connectivity); and 3) Networking assets (the relationships among the various actors that help advance new ideas).

This paper analyzes the “Tech Square” project. It was built from 2001 to 2003 and simultaneously expanded the size and scope of the Georgia Institute of Technology, a major public research university with an urban campus. The project was initially driven by the need for more programming and academic space, but multiple factors shaped it into the foundation of a growing innovation hub. This case study uses a review of the literature on university knowledge and technology transfer; archival records; interviews; contemporary accounts; and mapping to build an ex post evaluation of Tech Square based on evolving theories of innovation district design. This study makes key contributions through a close examination of the physical form of Tech Square and how it was shaped by its particular Triple Helix environment.

In addition, the Tech Square case highlights how the U.S. political context of limited government funding for university expansion necessitates a more creative economic development role for universities as anchor institutions. The findings of this study will be of interest to practitioners and scholars of economic development, public policy, urban planning and design, public-private partnerships, and higher education seeking to better understand the evolving role of research-intensive urban universities in building and shaping innovation districts.

**Keywords:** Innovation Ecosystems, Anchor Institutions, Triple Helix, Knowledge and Technology Transfer, Regional Innovation Systems

## Introduction:

This paper describes how the particular spatial, political, and economic context of one major American research university drove a major expansion of its campus and profile. In hindsight, this expansion has been widely recognized as a successful example of entrepreneurial place-making by a university to build a thriving urban innovation and entrepreneurial district. However, its roots predate recent trends in urbanization and innovation districts. It offers useful lessons in how a unique set of circumstances and actors came together in time and place to shape the built environment of the campus and city. It further argues that the diversity of urban forms within this one university offer unique opportunities for studying relationships between physical place and innovation.

## Literature Review:

The notion of linking academic research to applied commercial activity dates to the earliest technological institutes and polytechnics of Europe in the 18th Century. The practical-arts model is central to the American land-grant university, which originally focused on agricultural education, but expanded to include mechanical arts and engineering (Curry and Kenney, 1990). The attention to industrial education gained more attention in the U.S. as leaders saw the need for developing a more sophisticated workforce for economic production. Technology historian David Noble argues the greatest period for science-based industrial expansion in the U.S. happened between 1880 and 1920, when the modern electrical industry merged scientific discovery and mechanical application in the workshop. The legal and educational foundation of applied science was built in this period, including patent systems, R&D laboratories (both proprietary and educational), and technical training programs (Noble, 1977). The purest application of the model in the U.S. higher education system are seen in technological institutes like Rensselaer Polytechnic Institute (founded 1824) and Massachusetts Institute of Technology (1861).

The modern conceptual framework of university-knowledge transfer is defined by Minshall as “all about the transfer of tangible and intellectual property, expertise, learning and skills between academia and the non-academic community.” Agrawal divides the modern literature into four areas, each with its own body of empirical approaches (Agrawal, 2001):

- Firm Characteristics, including Cohen and Levinthal’s “absorptive capacity” theory on how firms take in and apply external knowledge (Cohen and Levinthal, 1990). Other characteristics include connectedness, spin-off firms, and talent attraction.
- University Characteristics, including policies on intellectual property, licensing, and characteristics of research faculty. In the United States, the Bayh-Dole Act of 1980, allowing licensing of inventions that result from federal funding, is a major policy factor.
- Geography in Terms of Localized Knowledge Spillovers, especially the transaction costs of tacit knowledge that increase with physical distance.
- Channels of Knowledge Transfer, meaning the various methods by which knowledge is transmitted from university to industry, including patents, publications, informal meetings, and others.

The transfer activity of each university takes place in its own particular context of governmental, political, legal, and cultural factors (Bozeman, 2000). One conceptual model for understanding these interactions is the Triple Helix by Etzkowitz and Leydesdorff. They argue there is a global understanding across very different political and cultural systems that the interactions of governments, universities, and private industries are vital to knowledge production and economic development (Etzkowitz and Leydesdorff, 1997).

A key element is the “entrepreneurial university” with four pillars: “1) Academic leadership able to formulate and implement a strategic vision; 2) Legal control over academic resources, including physical property emanating from research; 3) Organizational capacity to transfer technology through patenting, licensing, and incubation; and 4) An entrepreneurial ethos among administrators, faculty, and students” (Etzkowitz, 2008). He asserts that the major research university has become the driver of the Triple Helix environment, under the control of neither

government nor industry. Youtie and Shapira note that Georgia Tech exemplifies this kind of regional development strategy through a combination of institutional leadership and boundary-spanning programs, like the Georgia Tech Research Institute applied-research arm; the Advanced Technology Development Center (a high-tech incubator founded in 1981); and the development of Tech Square (Youtie and Shapira, 2008). Bercovitz and Feldman identify five primary mechanisms of formal and informal transfer: 1) Sponsored Research; 2) Licenses; 3) Hiring of Students; 4) Spin-off firms; and 5) Serendipity. They conclude entrepreneurship is highly dependent on physical co-location, though not licensing. Serendipity describes “an informal mechanism that might be used to initiate a relationship, which subsequently develops through other mechanisms” (Bercovitz and Feldman, 2006).

Co-location and serendipity naturally lead to the relationship of innovation and physical space. In a broad, chronological review of the literature on innovation and space, Simmie notes building empirical evidence for a “distinctive geography” of innovation (Simmie, 2005), though its nature and how to measure it is an ongoing debate. Agglomeration economies and clustering have been studied at varying scales since the first half of the 20<sup>th</sup> Century, largely focused on global, national, regional, and metropolitan areas. Both scholarly and popular perspectives of the last decade have focused on the urbanization (or re-urbanization) of technology and other high value-added sectors (Krugman, 1991, Glaeser, 2011, Katz, 2014).

In 1996, Markusen introduced a typology of “industrial districts” in addressing the lingering tendency of innovation to stay in place, despite the declining transaction cost of distance. She termed it “Sticky Places in Slippery Space” (Markusen, 1996). One type was the “state-centered district,” in which a major government entity is the anchor, such as a capital city, military base, or research institution. Clark notes universities located in regions “with the ‘fertile ground’ provided by strong entrepreneurship cultures, well-developed firm networks and industry clusters, and/or established economic development institutions” have better success with technology transfer (Clark, 2014). However, physical proximity alone is not enough. Boschma argues there are multiple dimensions of proximity beyond space, such as organizational, social, and institutional factors (Boschma, 2005).

The Brookings Innovation Districts model incorporates physical place as a key element in what is otherwise a variation on the Triple Helix model of actors (Katz, 2014). It considers three sets of assets:

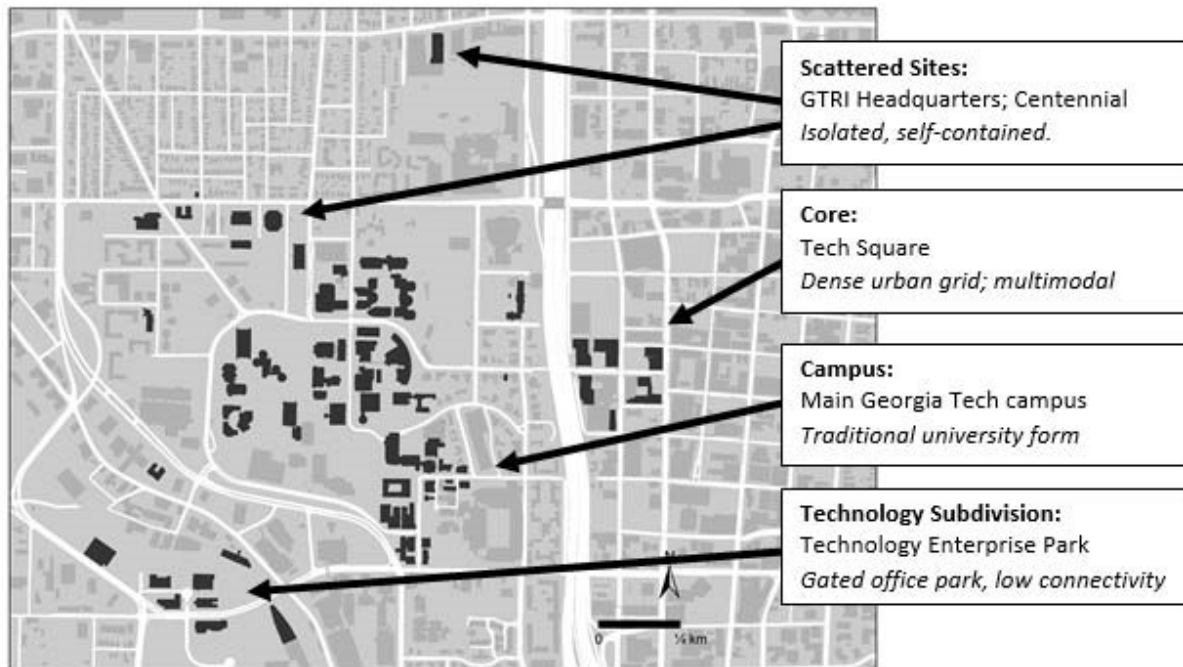
- “Economic assets are the firms, institutions and organizations that drive, cultivate or support an innovation-rich environment.
- “Physical assets are the public and privately-owned spaces—buildings, open spaces, streets and other infrastructure—designed and organized to stimulate new and higher levels of connectivity, collaboration, and innovation.
- “Networking assets are the relationships between actors—such as between individuals, firms, and institutions—that have the potential to generate, sharpen, and/or accelerate the advancement of ideas.”

There is no single spatial form of innovation in the U.S. Innovation spaces are shaped by various competitive funding inputs, both government and corporate, as well as prevailing political, economic, and cultural factors. Clark notes that there is a perception that scientific research is often conducted in the leafy suburban office park, like Palo Alto Research Center (PARC) in California and Research Triangle Park in North Carolina. This perception is also shaped by the prevailing patterns of development during peak periods of American corporate expansion (O'Mara, 2005), and rural locations driven by security (Clark, 2014). Forsyth developed the following typology for high-technology districts: corridors, clumps, cores, campuses, subdivisions, and sites (Forsyth, 2014). The Brookings model divides innovation districts into three main physical forms:

- “Anchor-plus model” exemplified by development around major research universities, such as Georgia Tech, MIT in Cambridge, Massachusetts, and the University of Pennsylvania.
- “Re-imagined urban areas,” like those in South Boston, Massachusetts, and South Lake Union in Seattle, Washington.
- “Urbanized science park,” like Research Triangle Park, which has a traditional suburban layout, but is developing a new, denser mixed-use core to offer more retail amenities and housing on-site.

Georgia Tech and some other large urban universities have examples of all these forms within the same ecosystem, as illustrated in Figure 1.

Figure 1: Map of all Georgia Tech academic and research buildings, categorized by Forsyth typology of high-technology districts.



A central issue in the study of urban form in innovation districts is the concept of the “Third Place,” describing places for socializing, business transactions, network-building, and self-identity. These can be bars, cafes, barber shops, hair salons, park benches, restaurants, playgrounds, or any other common space (Mehta & Bosson, 2010). They focus on four characteristics: Personalization; Permeability (referring to the visual and physical transparency of the building at street level); Seating; and Shelter from elements.

Figure 2: Illustration of methodology employed by Mehta to measure and observe street life in Cambridge, Massachusetts. Source: (Mehta, 2007). Figure 3: Streetscape in Tech Square, with shade, public and private seating, and permeable ground-level uses.

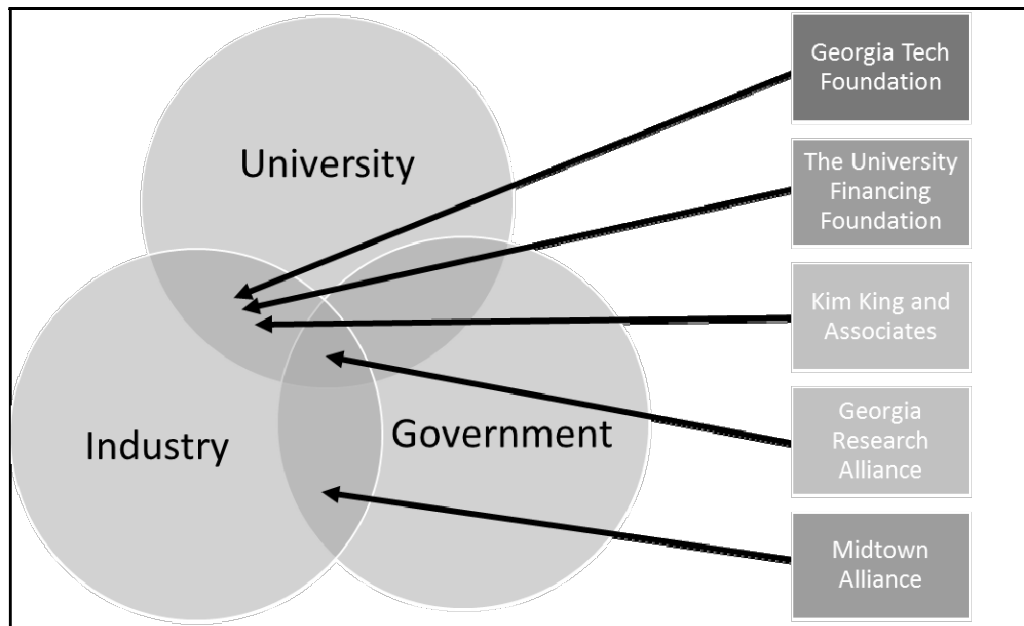


## Placemaking by an entrepreneurial university:

This paper revisits the conception and development of the Technology Square innovation district (“Tech Square”) to demonstrate the following: That the conceptual and physical form of this university-based innovation district was shaped by a particular environment of boundary-spanning organizations that blurred the traditional barriers and roles among institutions, governments, and industry. The following non-traditional organizations are considered, in no particular order of importance, and rendered conceptually in Figure 4:

- **Georgia Tech Foundation, Inc.:**  
*Triple Helix form: Hybrid of Institution and Industry; alternative to Government funding.*  
*Brookings form: Economic asset and facilitator of Networking assets, ability to shape Physical assets*
  - Because public universities often have capital and operational needs well beyond state funding, most have non-profit foundations for raising private and philanthropic funds in support of the university’s goals. The Foundation’s Board of Directors includes influential alumni and corporate leaders, including real estate developers (“2013 Georgia Tech Foundation Annual Report”, 2013).
- **The University Financing Foundation:**  
*Triple Helix form: Hybrid of Institution and Industry; substitution for Government*  
*Brookings form: Economic asset, ability to conceive and finance Physical assets*
  - This non-profit consulting firm works with universities to conceive, plan, and finance major capital projects using a variety of tools, such as tax-exempt bonds. It has been responsible for financing several major Georgia Tech research facilities, including the southern portion of Tech Square (Long, 2014).
- **Georgia Research Alliance:**  
*Triple Helix form: Hybrid of Institution/Government/Industry*  
*Brookings form: Economic and Networking asset*
  - This non-profit consortium recruits top scientists, invests in research technology, funds commercialization of state university inventions, and facilitates partnerships between industry and universities. While its literature does not specifically refer to the Triple Helix theory, its own description is clear: “The Georgia Research Alliance was created in 1990 through a rare but powerful alignment of business, academic and government interests — a shared vision for making the state a powerhouse for leading-edge university research and development” (“Georgia Research Alliance: The First 20 Years”, 2010).
- **Midtown Alliance/Midtown Improvement District:**  
*Triple Helix form: Hybrid of Government and Industry; Institution is member*  
*Brookings form: Economic asset, with influence in shaping and providing services to Physical assets*
  - This non-profit business association represents Midtown Atlanta property owners and businesses. Its Community Improvement District (CID) is a self-taxing quasi-governmental organization empowered to assume some traditional government roles, including planning, design approval, security, municipal services, and infrastructure investments (Morçöl and Zimmermann, 2006).
- **Kim King and Associates:**  
*Triple Helix form: Industry, with strong affiliation to Institution.*  
*Brookings form: Economic and Networking asset, creator of Physical asset*
  - This private real estate development firm spanned multiple roles through its founder, Kim King. He was a popular student-athlete on Georgia Tech’s American football team in the 1960s. He later became a successful real estate developer and served on the Board of Directors of the Georgia Tech Foundation. He also served as the campaign chairman for Georgia Gov. Roy Barnes, who served from 1999 to 2003.

Figure 4: Conceptual model of traditional Triple Helix actors and overlap of non-traditional actors.



The Georgia School of Technology (now Institute) was created by an act of the Georgia General Assembly (legislature) in 1885 with the intention of expanding the state's industrial knowledge base, skills, and capacity (Brittain, 1948). The Reconstruction period following the American Civil War (1860-1865) made clear the need for agrarian Southern states to build capacities for technological and scientific knowledge production. In that sense, economic development, knowledge transfer, and commercialization were built in to the Institute's purpose. The Institute was originally built on the outskirts of Atlanta in 1885, but it was gradually surrounded by the city. In the mid-20<sup>th</sup> Century, a major expressway built along the eastern edge of campus became a major physical and mental barrier from the rest of the city. The following decades saw suburban flight and urban decline, while the university closed itself off from the surrounding city (*Making the Vision a Reality*, 2013).

Figure 5 (left): Midtown Atlanta, Georgia, USA, at Fifth Street, before the development of Tech Square. Figure 6 (right): Tech Square soon after construction, before the Fifth Street Bridge was converted. The large brick structure with two towers is the former Biltmore Hotel. Source: Georgia Tech News Service.



By the late 1980s, disinvestment in the urban core of Atlanta had largely hit its nadir, though some parts of Midtown and other in-town historic neighbourhoods were seeing reinvestment (Bayer, 1989). In the early 1990s,

civic leaders began what was seen as an unlikely effort to attract the 1996 Olympic Games. A wave of mostly private investment in athletic facilities and accommodations was built at Georgia Tech. Multiple subjects note this surge of investment as an unusual and unreplicable factor in subsequent capital planning by the university (Hutchins, 2015, Swant, 2014, Carter, 2014). Another important legacy was technology infrastructure, in the form of a robust fiber-optic network installed throughout Georgia Tech's campus and Midtown Atlanta (Hutchins, 2015, Hayes, 1996).

In 1997, as very preliminary ideas for future Georgia Tech development were discussed, the Midtown Alliance started a comprehensive community plan called Blueprint Midtown. Among the two largest elements were the largest rezoning in city history, which established a future framework for land use and design; and the creation of the Midtown Improvement District in 2000 (Powell and Lee, 2015). Following the Olympics, Georgia Tech leaders developed new campus master and capital plans (Clough, 2001). There were still pressing needs for updated academic and research space, including new homes for the College of Management and continuing education (Clough, 1999). The Georgia Tech Foundation began acquiring land across the highway from the main campus, even before it was clear whether the campus would expand in that direction (Long, 2014). In 1998, another prominent Georgia Tech alumnus and real estate developer, Jim Borders, renovated the large Biltmore hotel, which had stood vacant for more than a decade. Other major investments in Midtown were taking root, such as the new U.S. Federal Reserve bank and Emory HealthCare (Powell and Lee, 2015).

In response to the needs expressed by then-Georgia Tech President Wayne T. Clough, the Georgia Tech Foundation commissioned a feasibility report on development in Midtown in 1998. In 1999, board members visited similar university-driven developments elsewhere in the U.S. (Long, 2014, Clough, 2001). Dozens of iterations of the development concept were considered before the project was approved by the Foundation in 2000 (Hall and Byrne, 2015). The university's initial development plan was limited to an executive/continuing education center and a hotel/conference center (Clough, 2001). Initially there was resistance to moving a full-time academic unit across the interstate (Hall and Byrne, 2015). Interview subjects describe a "snowballing" effect of uses to meet expectations for foot traffic and occupancy. Retail stores and a new campus bookstore were added to serve as attractors of students and visitors. The College of Management was added in 2000. All the preceding projects were built by the Georgia Tech Foundation and financed with tax-exempt bonds, with the expectation that they would either transfer or hand over ownership of the facilities to Georgia Tech (Long, 2014). Ultimately, the scope of the GTF portion of the project totalled 102,200 square meters of floor space.

It became clear that the project required a private partner to build the other half of commercial office and lab space, along with ground-floor retail (Carter, 2014). One reason is that tax-exempt bonds have restrictions against for-profit use. Kim King, the Georgia Tech alumnus, committed to developing the private component, which would rent a significant amount of space to various Georgia Tech entities and private firms. As the seller of the land, the Georgia Tech Foundation required the developer to follow the same scale and exterior design as the south side of the street (Long, 2014). This ensured a cohesive appearance, despite the different owners.

Throughout the design process, the City of Atlanta's departments of planning and public works weighed in on elements of the site plans, zoning, utility service, and design (Dobbins, 2015). By this time, the Blueprint Midtown comprehensive plan was in effect, giving Midtown Alliance design and zoning input on new construction projects (Hall and Byrne, 2015). Zoning required a "step-up" approach of five-floor buildings in front, with a 14-floor tower in the rear. The final outcome was an iterative process among the committee, city staff, the developers, the architects, and the institute (Powell and Lee, 2015). Dobbins, who was planning commissioner at the time, said the City's priority was to support Midtown Alliance in creating a more integrated street grid.

The private portion of the development is home to the majority of innovation and entrepreneurship activity in Tech Square, largely because of the decision to locate Georgia Tech's business incubator, Advanced Technology Development Center (ATDC) there. Another factor was the Yamacraw Electronic Design Center, which was part of an effort by Georgia Governor Roy Barnes to make the state a leader in the design of high-bandwidth communications systems (Rogers, 1999). The Georgia Research Alliance was a partner. A symbolic monument to governmental relationship-building of Tech Square came three years after Tech Square opened in 2003. The

widening of the Fifth Street Bridge better connected the new development to the main campus by widening the passage, reducing car capacity, and adding sidewalks, bicycle lanes, and green space. Interviewees again cited relationships of key alumni with the governor as a factor in moving the project forward.

*Figure 7 (left): Bridge between Tech Square and main campus before expansion. Source: Georgia Tech Archives. Figure 8 (right): Bridge after expansion, with American college football fans “tailgating” before a match. Source: Author.*



## Key Factors/Findings:

In summary, Tech Square is an urban innovation district driven by an entrepreneurial university and shaped by both formal and informal Triple Helix relationships, in the following areas:

- **Site selection:** While Institutional leadership drove the need to expand, the ultimate decision of where to expand was driven by a group of actors with deep experience in private Industry, while simultaneously acting in the interests of the Institution.
- **Development concept/mixed uses:** The Institution’s space needs initially drove the development concept, but it was greatly expanded by both Industry and the economics of higher urban land costs. The iterative Triple Helix environment informed the final concept. Key political connections between Government and Industry drove tenant location decisions.
- **Funding:** A lack of regional Government will or ability to fund all capital needs for the (public) Institution created a need for Industry and Institution to seek alternative financing.
- **Architecture and urban design:** The Institution (via internal and external design staff), Government (via zoning and design review), and Industry (via external design staff and business models) all contributed to the physical form of Tech Square. Industry and Government merged in the form of Midtown Alliance to shape urban planning and design outcomes.
- **Connectivity and Infrastructure:** Industry, Government, and Institution combined efforts and relationships to make a key physical connection to the main campus over the highway. The Institution offers frequent shuttle service to main campus and rail transit. Government offers infrastructure in the form of streets, sidewalks, expressway, rail and bus transit, and other public services. Industry and Institution combined on an extensive fiber-optic network for Olympics.

## Conclusion and suggestions for further research:

With this understanding of how the location and physical form of Tech Square was shaped, why does it matter? If future research builds more support for a positive relationship between place and innovation, then it is important to understand physical form. In the case of Georgia Tech, a major research university with a traditional campus made an assertive expansion into a dense urban grid. In the decade since, dozens of established firms have moved or opened offices at Tech Square to benefit from proximity to the university, as well as competitors and partners.



Figure 9: A symbolic map of startups, established technology firms, incubators, major corporate offices, and other entities connected to Midtown Atlanta's technology ecosystem, with clustering at Tech Square.

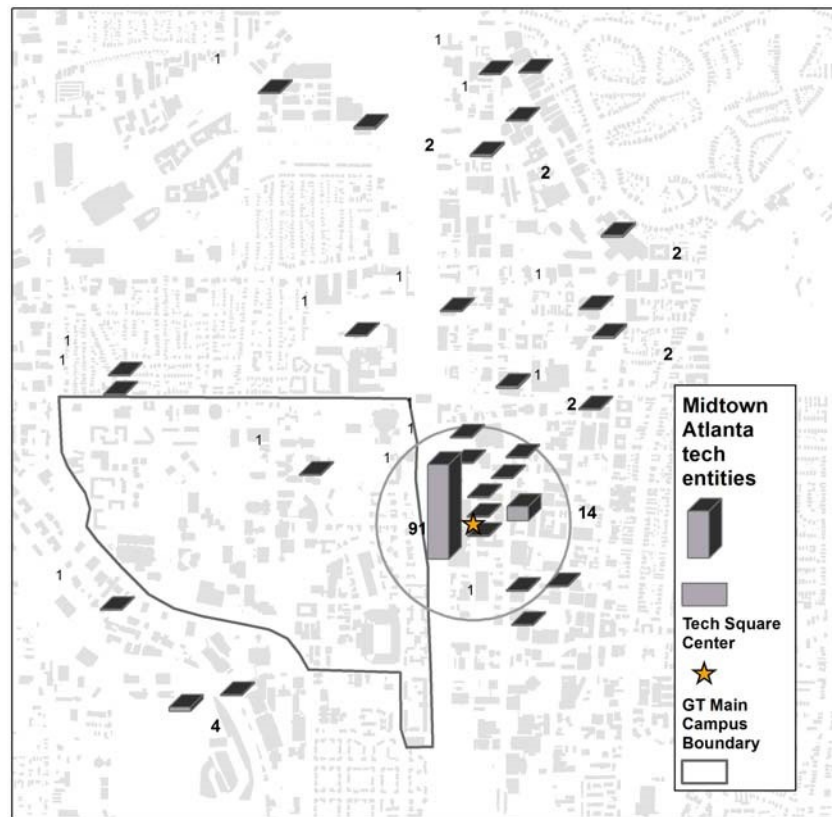


Figure 9 depicts the clustering of a variety of entities often connected with innovation ecosystems: startup firms, incubators, established technology firms, major corporate offices, “corporate innovation centers,” venture capital investors, and various business service providers (source here for lists). The Centergy One building alone houses 91 entities, including corporate innovation centers for Coca-Cola Enterprises and AT&T. In 2015, NCR Corp., which invented the cash register in 1879, announced it was leaving Atlanta’s suburbs to build a new headquarters one block north of Tech Square (Karkaria, 2015). NCR and other firms stress the importance of proximity and serendipity in their location decisions, as well as American trends toward urbanization. Tech Square has never had a residential component, but the market has responded with apartments targeted to both students and young professionals. Within 0.25 miles (0.4 km), 1,953 apartment units and 6,410 square meters in retail space are either under construction or planned. At least another 93,000 square meters in new office space is planned in both NCR’s new headquarters and a data center commissioned by the university. Multiple interviewees and media reports confirm that the district has become the cultural and social center of Atlanta’s technology community, though startup activity is growing in other parts of the city (Henderson, 2015). Ongoing infrastructure investments by Midtown Alliance prioritize walking, biking, and transit use. The City and the Alliance have various programs to promote energy and water efficiency in buildings.

The development and execution of Tech Square offers a compelling application of the Triple Helix theory that is particular to the political and economic context of U.S. cities. The Triple Helix thesis captures extra-governmental actors (CIDs) and influential actors moving in concert with a major urban research university in ways that blur separation among the traditional three elements and create a tangible physical environment for innovation and entrepreneurship.

There are several avenues for future research. A formal test of the Triple Helix theory could be accomplished by comparing more university-led development projects. The Brookings framework of physical place, along with other typologies of urban form, could be tested by analysing a sample of innovation districts and evaluating their performance by a range of innovation metrics. A particular advantage in studying university ecosystems is that major U.S. universities track innovation and commercialization metrics closely, along with space usage. It is possible to link these internal data to test for relationships between innovation and physical form. In the case of Georgia Tech and some other universities, there are examples of differing urban forms in the same institution. It is clear that there is fertile ground for both near-term planning of innovation districts and a long-term understanding of smaller-scale knowledge dynamics.

## Sources:

- 2013 Georgia Tech Foundation Annual Report. (2013). Atlanta: Georgia Tech Foundation, Inc.
- Agrawal, A. (2001). University to Industry Knowledge Transfer: Literature Review and Unanswered Questions. *International Journal of Management Reviews*.
- Bayor, R. H. (1989). Urban renewal, public housing, and the racial shaping of Atlanta. *Journal of Policy History*, 1, 419-439.
- Bercovitz, J. & Feldman, M. (2006). Entrepreneurial Universities and Technology Transfer: A Conceptual Framework for Understanding Knowledge-Based Economic Development. *Journal of Technology Transfer*, 31, 175.
- Bozeman, B. (2000). Technology transfer and public policy: A review of research and theory. *Research Policy*, 29, 627.
- Brittain, M. L. (1948). *The story of Georgia Tech*, Univ. of North Carolina Press, Chapel Hill.
- Carter, J. (2014). Interview with John Carter, former President and COO of Georgia Tech Foundation. In: Giuffrida, G. (ed.).
- Clark, J. J. (2014). Siting scientific spaces in the US: the push and pull of regional development strategies and national innovation policies. *Environment and Planning C: Government and Policy*, 0, 0-0.
- Clough, G. W. (1999). Strategic Planning for Facilities. *Presentation to Georgia Tech Foundation*. Georgia Institute of Technology: Atlanta, Ga.
- Clough, G. W. (2001). *Technology Square Presentation*, Georgia Institute of Technology, Atlanta, Ga.
- Cohen, W. M. & Levinthal, D. A. (1990). Absorptive Capacity: A New Perspective On Learning And Inno. *Administrative Science Quarterly*, 35, 128.
- Curry, J. & Kenney, M. (1990). Land-Grant University-Industry Relationships in Biotechnology: A Comparison with the Non-Land-Grant Research Universities. *Rural Sociology*, 55, 44.
- Dobbins, M. (2015). Interview with Michael Dobbins, FAICP, FAIA, Professor of the Practice, Georgia Tech School of City and Regional Planning. In: Giuffrida, G. (ed.).
- Etzkowitz, H. (2008). *The triple helix: University-industry-government innovation in action*, Routledge, New York.
- Etzkowitz, H. & Leydesdorff, L. A. (1997). *Universities and the global knowledge economy : a triple helix of university-industry-government relations*, London ; New York, Pinter.
- Forsyth, A. (2014). Alternative forms of the high-technology district: corridors, clumps, cores, campuses, subdivisions, and sites. *Environment and Planning C: Government and Policy*, 32, 809-823.
- Georgia Research Alliance: The First 20 Years. (2010). Atlanta: Georgia Research Alliance.
- Glaeser, E. (2011). *Triumph of the City: How Our Greatest Invention Makes Us Richer, Smarter, Greener, Healthier, and Happier* New York Penguin Press HC.
- Hall, T. H., Iii & Byrne, K. T. T., David (2015). Interview with leaders of The University Financing Foundation (TUFF) and Gateway Development Services. In: Giuffrida, G. (ed.).
- Hayes, M. B., Mike. (1996). Design for redundancy at the Centennial Olympic Games. *Cabling Installation & Maintenance* [Online]. Available: <http://www.cablinginstall.com/articles/print/volume-4/issue-10/contents/design/design-for-redundancy-at-the-centennial-olympic-games.html> [Accessed 2/2/2015].
- Henderson, S. (2015). Interview with Scott Henderson, founder of The Sandbox Crew. In: Giuffrida, G. (ed.).
- Hutchins, R. (2015). Interview with Ron Hutchins, Georgia Tech Chief Technology Officer. In: Giuffrida, G. (ed.).

- Karkaria, U. (2015). Coca-Cola Enterprises to put innovation center at Georgia Tech. *Atlanta Business Chronicle*, 1/28/2015.
- Katz, B. W., Julie (2014). The Rise of Innovation Districts: A New Geography of Innovation in America. *Metropolitan Policy Program at Brookings*.
- Krugman, P. R. (1991). *Geography and Trade*, Cambridge, Mass., MIT Press.
- Long, M. S., John C., Jr. (2014). Joint interview with Mark Long, Chief Financial Officer, Georgia Tech Foundation Inc., and John C. Staton Jr., former Chairman of GTF Board of Directors. *In: Giuffrida, G. (ed.)*. Released. Short video documentary. *Making the Vision a Reality*. (Year) Atlanta: Georgia Tech News Service.
- Markusen, A. (1996). Sticky Places in Slippery Space: A Typology of Industrial Districts. *Economic Geography*, 72, 293.
- Mehta, V. (2007). Lively Streets: Determining Environmental Characteristics to Support Social Behavior. *Journal of Planning Education and Research*, 27, 165-187.
- Morçöl, G. & Zimmermann, U. (2006). Community Improvement Districts in Metropolitan Atlanta. *International Journal of Public Administration*, 29, 77-105.
- Noble, D. F. (1977). *America by design: Science, technology, and the rise of corporate capitalism*, New York, Knopf.
- Powell, S. & Lee, S. (2015). Interview with Shannon Powell, Vice President of Operations for Midtown Alliance, and Susannah Lee, Associate Project Manager. *In: Giuffrida, G. (ed.)*.
- Rogers, V. (1999). Barnes unveils Yamacraw initiative as blueprint for state's economy. *The Whistle*, 1/18/1999.
- Simmie, J. (2005). Innovations and Space: A Critical Review of the Literature. *Regional Studies*, 39, 789.
- Swant, S. (2014). Interview with Steven Swant, Georgia Tech's Executive Vice President for Administration and Finance. *In: Giuffrida, G. (ed.)*.
- Youtie, J. & Shapira, P. (2008). Building an innovation hub: A case study of the transformation of university roles in regional technological and economic development. *Research Policy*, 37, 1188-1204.