TECH CITIES 1.0
A FIRST LOOK AT METRICS TO WATCH
Click below to explore what makes a city a “tech city”
WHAT MAKES A CITY A “TECH” CITY?

Throughout this and most other business cycles we hear that tech cities have outperformed other markets by virtually every relevant economic and commercial real estate (CRE) metric, including GDP, jobs, absorption, rents, and more. But what exactly is a tech city? After all, technology is everywhere. What company today doesn’t use internet, cloud computing, social media, smart phones, or more advanced machinery and equipment? However, certain cities stand out. In these markets, tech plays a larger role in the city’s economic trajectory. It’s also a vibe. Certain cities have the tech feel in the air, on the signage, in the conversations at the bars, in its population’s habits and preoccupations. In certain cities, tech is more deeply woven into the fabric of the city itself, and it’s dramatically shaping those local real estate markets.
Cushman & Wakefield set out to take a look at tech cities in the U.S., exploring big players today and those to watch. Is your city a tech city?

Tech Cities 1.0 takes a close look at market drivers – in an effort to distinguish tech cities across the U.S.

There are key characteristics of an environment that supports, nurtures, and promotes the formation of tech cities. We call it “tech stew.”

The “tech stew” metric ingredients are:

- **INSTITUTIONS OF HIGHER LEARNING**
- **CAPITAL**
- **TECH WORKERS**
- **KNOWLEDGE WORKERS**
- **EDUCATED WORKERS**
- **GROWTH ENTREPRENEURSHIP**

Tech Cities 1.0 is the first release in a series of reports focused on opportunities created from the expansion of the tech industry as it relates to CRE in the U.S. Throughout 2017 and beyond, we will continue to explore what makes a city a “tech city” and monitor tech’s impact on CRE.
WHAT MAKES UP "TECH STEW"?

“Tech stew” essentially boils down to six key ingredients – local universities, capital, tech workers, knowledge workers, educated workers, and entrepreneurial spirit. Each thriving tech market has a distinct essence based on the proportions of each metric, which the following section defines and examines.
TECH METRICS

INSTITUTIONS OF HIGHER LEARNING.
Leading universities that provide creative impetus, research, and that lead to creation of new companies.
LEARN MORE >>

VENTURE CAPITAL.
The capital to take those ideas and turn them into companies.
LEARN MORE >>

TECH WORKERS.
An ample supply of workers within a market’s technology industry; leaders within tech who understand the requirements of the sector.
LEARN MORE >>

KNOWLEDGE WORKERS.
An available workforce with the skills to work in a tech-focused company. These workers are in occupations that support a tech environment, including legal, accounting, and other knowledge-driven occupations.
LEARN MORE >>

EDUCATED WORKERS.
A high level of education is essential to supporting the growth of these companies.
LEARN MORE >>

GROWTH ENTREPRENEURSHIP.
Starting a company is one thing. Creating a growth engine is something else. Cities that have a higher concentration of growth engines are great tech locations.
LEARN MORE >>
The presence of one or more local, high-profile universities where research is being conducted is an important characteristic of tech markets. These institutions are comprised of a high concentration of talented teachers, researchers, and students, and foster critical thinking, innovation, creativity, and competitiveness.

These universities offer more than just a degree—other important factors include: links to industry partners, businesses, and professional groups; the presence of incubator facilities; a variety of extracurricular activities and societies; and work experiences and internships that can prove to employers a student has the attitude and aptitude to succeed.

Fostering a tech environment, these universities have high-quality laboratories and research centers, offer research opportunities to their students and faculty, and produce winners of prestigious awards in innovation.

Highly ranked universities facilitate research, development, and collaborations to commercialize the discoveries and inventions that emerge from the institutions. Sizable budgets aid in the success of elite institutions in the form of endowment income, government funding, and contract research from private firms and public organizations. High-profile universities are crucial to establishing a market as a tech environment because they attract young startup talent and provide an environment in which professors and students can create and develop ideas that they can then turn into products or services.

High-profile universities attract young startup talent and provide an environment in which professors and students can create and develop ideas that they can then turn into products or services.
## Institutions of Higher Learning

<table>
<thead>
<tr>
<th>Region</th>
<th>Institutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlanta, GA</td>
<td>Emory University, Georgia Institute of Technology, Spelman College, Mercer University, University of Georgia, Morehouse College, Oglethorpe University, Berry College, Georgia State University</td>
</tr>
<tr>
<td>Austin, TX</td>
<td>Rice University, UT Austin, Trinity University, Texas A&amp;M University, Baylor University</td>
</tr>
<tr>
<td>Baltimore, MD</td>
<td>Johns Hopkins University, University of Maryland, Loyola University</td>
</tr>
<tr>
<td>Boston/Cambridge, MA</td>
<td>MIT, Harvard University, Amherst College, Tufts University, Wellesley College, Smith College, Boston University, Boston College, Worcester Polytechnic Institute, Northeastern University, College of the Holy Cross, Brandeis University, Bentley University, Babson College, Mount Holyoke College, Wheaton College, Stonehill College, Simmons College, UM Amherst</td>
</tr>
<tr>
<td>Chicago, IL</td>
<td>University of Chicago, Northwestern University, University of Illinois at Chicago, Illinois Institute of Technology, Loyola University Chicago</td>
</tr>
<tr>
<td>Columbus, OH</td>
<td>Ohio State University, Denison University, Kenyon College, Ohio Wesleyan University</td>
</tr>
<tr>
<td>Dallas/Ft. Worth, TX</td>
<td>Southern Methodist University, Texas Christian University</td>
</tr>
<tr>
<td>Denver/Boulder, CO</td>
<td>University of Denver, Colorado School of Mines, UC Boulder</td>
</tr>
<tr>
<td>Indianapolis, IN</td>
<td>Purdue University, DePauw University, Indiana University, Butler University</td>
</tr>
<tr>
<td>Kansas City, MO/KS</td>
<td>William Jewell College, University of Missouri – Kansas City</td>
</tr>
<tr>
<td>Los Angeles, CA</td>
<td>California Institute of Technology, USC, UCLA, The Claremont Colleges, Occidental College, UC Santa Barbara, Loyola Marymount University, Pepperdine University, UC Irvine, UC San Diego, University of San Diego</td>
</tr>
<tr>
<td>Madison, WI</td>
<td>UW Madison</td>
</tr>
<tr>
<td>Minneapolis/St. Paul, MN</td>
<td>Carleton College, Macalester College, University of Minnesota, Gustavus Adolphus College, St. Olaf College</td>
</tr>
<tr>
<td>Nashville, TN</td>
<td>Vanderbilt University</td>
</tr>
<tr>
<td>New York/New Jersey</td>
<td>Princeton University, Columbia University, Cornell University, NYU, Rutgers, The State University of NJ, Stevens Institute of Technology</td>
</tr>
<tr>
<td>Oakland/East Bay, CA</td>
<td>Stanford University, UC Berkeley, UC Davis, University of the Pacific, Santa Clara University, University of San Francisco</td>
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<tr>
<td>Orange County, CA</td>
<td>California Institute of Technology, USC, UCLA, The Claremont Colleges, Occidental College, UC Santa Barbara, Loyola Marymount University, Pepperdine University, UC Irvine, University of San Diego</td>
</tr>
<tr>
<td>Portland, OR</td>
<td>University of Oregon, Oregon State University, Oregon Health and Science University</td>
</tr>
<tr>
<td>Raleigh/Durham/Chapel Hill, NC</td>
<td>Duke University, UNC Chapel Hill, Wake Forest University, Davidson College, North Carolina State University, Elon University</td>
</tr>
<tr>
<td>Salt Lake City, UT</td>
<td>Brigham Young University</td>
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<tr>
<td>San Diego, CA</td>
<td>California Institute of Technology, USC, UCLA, The Claremont Colleges, Occidental College, UC Santa Barbara, Loyola Marymount University, Pepperdine University, UC Irvine, University of San Diego</td>
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<tr>
<td>San Francisco/San Mateo, CA</td>
<td>Stanford University, UC Berkeley, UC Davis, University of the Pacific, Santa Clara University, University of San Francisco</td>
</tr>
<tr>
<td>San Jose (Silicon Valley), CA</td>
<td>Stanford University, UC Berkeley, UC Davis, University of the Pacific, Santa Clara University, University of San Francisco</td>
</tr>
<tr>
<td>Seattle, WA</td>
<td>University of Washington, Seattle University, University of Puget Sound</td>
</tr>
<tr>
<td>Washington, DC</td>
<td>Georgetown University, George Washington University, Catholic University of America, University of the District of Columbia, Johns Hopkins University, University of Maryland, Loyola University, University of Virginia, University of Richmond, William &amp; Mary, Washington and Lee, Virginia Polytechnic Institute and State University, Hampton University, Virginia Military Institute</td>
</tr>
</tbody>
</table>
Venture capital (VC) is key to the tech industry, as this funding drives not only startups but companies at various stages in their life up to any possible M&A or IPO.

In 2016, VC deal value was the second strongest in the current cycle at $74.3 billion, according to PitchBook and the National Venture Capital Association. That was 9.6% below the level of 2015’s $82.2 billion, far below the $91 billion and $188 billion invested that PwC Moneytree reported for 1999 and 2000, respectively.

Part of the slowdown in 2016 was due to the overheated activity during the previous two years; but another reason is that VC firms are now looking at quality over quantity. In other words, there is now a mandate to deploy capital in a more targeted manner with a higher level of review and oversight.

Still, there is a growing amount of capital targeted at tech startups. VC fundraising activity climbed higher in 2016, up 14.2% to $51.3 billion from $44.9 billion in 2015. Fund sizes also climbed (growing for five consecutive years now) with the median at $85 billion in 2016 versus $50 billion in 2015.

**2016 VC ACTIVITY**

Source: PitchBook

San Francisco/San Mateo

$28.5B

38% of total activity

New York City

$9.1B

San Jose (Silicon Valley)

$6.7B
Top investments by industry in 2016 were software, pharma & biotech, health care devices & supplies, commercial services, and health care services & systems.

Regarding funding stages, it was somewhat of a mixed bag:
- The average VC round for the angel/seed category has climbed each year since 2011; the number of deals, however, did decline from 2015 to 2016.
- The average size of early-stage VC funding climbed in 2016 as well; like the angel/seed category above, though, the number of deals declined.
- Regarding later stage VC funding, both the average size of the deal and the number of deals declined in 2016. It was the first year-over-year decline in size since 2013.

VC-backed exits were down from 2015 to 2016 across all major methods — whether acquisition, IPO, or buyout. Total exits fell to 1,152 from 1,507 year-over-year.

**U.S. HISTORICAL VC FUNDING**

*Source: PitchBook*

One or two major VC transactions can greatly influence the activity by quarter – a lack of major deals in Q4 2016 resulted in a sharp decline.
• For tech companies to thrive and grow, there needs to be a readily available workforce with the skill set needed.
  - These knowledge workers can work at any type of company, but they have skills that make them attractive to the tech sector.
• Knowledge workers are those whose occupations fall into one of the following broad categories:
  - Computer and mathematical
  - Architecture and engineering
  - Life, physical, and social science
  - Management
  - Education
  - Health care
• Knowledge workers account for approximately 31 million persons in the U.S. and 20% of the workforce. In the highest ranked cities, knowledge workers account for up to 35% of the labor force.
1.8% per year

National growth in knowledge occupations since 2010 - nearly double the rate of the previous five years

Knowledge Workers in the U.S.
Source: U.S. Bureau of Labor Statistics
There are many kinds of entrepreneurs and many kinds of startups, from the local cleaner to the emerging tech giant. From a commercial real estate perspective, the interesting companies are those with a high-growth profile that has extended over several years. These are the companies that have the potential to become important contributors to local economies and to become mainstays of the local commercial real estate environment.

The Kauffman Foundation, an organization that studies entrepreneurship and its impact on the economy, refers to these kinds of companies as growth entrepreneurs and has developed an index that measures the level of growth entrepreneurship across major U.S. metropolitan areas.

The Growth Entrepreneurship Index is made up of three components:

- **Rate of Startup Growth.** This statistic measures how many jobs are created by startups over a five-year time period.

- **Share of Scale-ups.** Fast-growing firms contribute more to the growth of a local region. The focus of this metric is on companies creating large numbers of jobs. It measures the number of firms that started small and grew to employ 50 or more people after 10 years of operation as a percent of all employers.

- **High-Growth Company Density.** This statistic measures the number of businesses that have at least $2 million in revenue and have averaged 20% growth over the previous three years.

Taken together, these three measures help to identify cities that have a mix of rapidly growing companies in different size ranges.

While not strictly a “tech” index, the cities that lead in growth entrepreneurship tend to be leading tech locations, including Austin, San Jose, and Boston (all in the top five). However, cities such as Washington, DC and Nashville also have a very healthy startup environment.
4.75

Average of Growth Entrepreneurship Index for Tech 25, far above the 0.32 for the U.S. as a whole

INDEX OF GROWTH ENTREPRENEURSHIP BY METRO AREA
Source: The Ewing Marion Kauffman Foundation
Tech workers are those whose employers fall into numerous categories and include occupancy of office, research and development (R&D), and manufacturing space. Some of the major categories (as defined by Moody’s Analytics) include:

- Computer systems design and related services
- Pharmaceutical and medicine manufacturing
- Computer and peripheral equipment manufacturing
- Software publishers
- Telecommunications
- Data processing, hosting, and related services
- Medical and diagnostic laboratories

Tech workers in the U.S. have hit a record high of more than 6.92 million in 2016, surpassing the previous peak of 6.86 million in 2001.

Not surprisingly, San Jose (Silicon Valley) has the largest percentage of tech workers to total nonfarm jobs at 27.4%; San Francisco/San Mateo is next up at 15.6%.

**MARKETS BY PERCENTAGE OF TECH WORKERS**

Source: BLS, Moody’s Analytics

Tech is 27.4% of the workforce in San Jose (Silicon Valley) — nearly double San Francisco.
• The New York metropolitan division has the most tech workers at almost 329,000, although its percentage to total nonfarm jobs is below the U.S. average at 4.8%.

• On a percentage basis, the number one growth market isn’t much of a surprise, but the sheer size of the jump may be — San Francisco/San Mateo, CA tech positions have grown by 104.7% over the past 10 years. The number two market might be an eye-opener — Madison, WI tech positions have increased by 52.2% over the past 10 years. And though still a relatively small percentage of the overall workforce, Nashville, TN has recorded an incredibly strong 40.4% rise in tech employment over the same time period.

**TECH WORKERS IN THE U.S.**

*Source: BLS, Moody’s Analytics*

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**The number of tech workers in the U.S. is expected to climb above 7.0 million for the first time in 2017, beating the previous record of 6.9 million in 2001.**
The educational attainment of a population is a major factor in tech markets, as an educated workforce is essential for the success and growth of these companies.

Educated workers are considered to be those who have earned a bachelor’s degree or higher.

The U.S. labor market is changing over time to demand a more skilled workforce. As workplaces and businesses become increasingly multifaceted and complex, employers need workers who are capable of adapting and excelling in these evolving environments.

As a consequence of an increasing number of job openings requiring advanced education, access to top position jobs is determined largely by college degrees. According to a report from the Center on Education and the Workforce at Georgetown University, 8.4 million jobs of the 11.6 million created after the recession (from January 2010 to January 2016) went to individuals with at least a bachelor’s degree.

Almost 31% of the U.S. workforce currently holds a bachelor’s degree or higher.

All of the Top 25 tech cities are above the U.S. average regarding educational attainment (bachelor’s degree or higher).

The top six markets are very close but San Francisco/San Mateo squeaks ahead of the pack.

**Educated Workforce**

**COMPUTER AND MATHEMATICAL SCIENCE OCCUPATIONS ARE GOING TO THE WELL-EDUCATED**

<table>
<thead>
<tr>
<th>Degree Level</th>
<th>Number</th>
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<tbody>
<tr>
<td>Bachelor’s Degree or Higher</td>
<td>870,000</td>
</tr>
<tr>
<td>Associate’s Degree or Higher</td>
<td>104,000</td>
</tr>
</tbody>
</table>

Change in employment from December 2007 to January 2016

Source: Center on Education and the Workforce

**EDUCATION DRIVES EMPLOYMENT**

72.7% of the jobs created from January 2010 to January 2016 went to people with a bachelor’s degree or higher.

Total change in employment from January 2010 to January 2016: +11.6 million
Top six markets have approximately 50% of their (25 and Over) population with bachelor’s degree or higher.

SHARE OF WORKFORCE WITH BACHELOR’S DEGREE OR HIGHER
Source: Moody’s Analytics, U.S. Census Bureau
Today's tech cities are what they are because of a “stew” made up of institutions of higher learning, investment funding, a well-qualified workforce, and entrepreneurship. They have outperformed the U.S. as a whole in terms of job growth, income growth, net absorption of office space, and rent growth over the past seven years. Cushman & Wakefield has created a Top 25 Tech Cities list, informed by these metrics, made up of both the expected inclusions along with a few revelations.
While tech-centric markets, such as Silicon Valley, San Francisco, and Boston show prominently, there were also some smaller, unexpected markets ranking high on the list, such as Madison, WI, Columbus, OH, and Nashville, TN.

1. **San Jose, CA (Silicon Valley)**
2. **San Francisco / San Mateo, CA**
3. **Washington, DC Region**
4. **Boston / Cambridge, MA**
5. **Raleigh / Durham / Chapel Hill, NC**

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<thead>
<tr>
<th></th>
<th>City</th>
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<th>City</th>
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<tbody>
<tr>
<td>6</td>
<td>Seattle, WA</td>
<td>16</td>
<td>Chicago, IL</td>
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<td>7</td>
<td>Austin, TX</td>
<td>17</td>
<td>Atlanta, GA</td>
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<tr>
<td>8</td>
<td>Denver / Boulder, CO</td>
<td>18</td>
<td>Los Angeles, CA</td>
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<td>9</td>
<td>San Diego, CA</td>
<td>19</td>
<td>Columbus, OH</td>
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<tr>
<td>10</td>
<td>Madison, WI</td>
<td>20</td>
<td>Orange County, CA</td>
</tr>
<tr>
<td>11</td>
<td>Minneapolis / St. Paul, MN</td>
<td>21</td>
<td>Dallas / Ft. Worth, TX</td>
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<td>12</td>
<td>Baltimore, MD</td>
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<td>Kansas City, MO</td>
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<td>13</td>
<td>Oakland / East Bay, CA</td>
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<td>Indianapolis, IN</td>
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<td>14</td>
<td>Portland, OR</td>
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<td>Salt Lake City, UT</td>
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<tr>
<td>15</td>
<td>New York City, NY</td>
<td>25</td>
<td>Nashville, TN</td>
</tr>
</tbody>
</table>

*The Bay Area and southern California markets were separated due to the diversification of market metrics.*
The following charts provide a snapshot of how key CRE fundamentals for the tech markets identified in this report (Tech 25) have stacked up against all other U.S. markets. Overall, since 2009, the Tech 25 have outperformed markets across the U.S.

**Employment Growth Since 2009**

- **Stronger job growth among the Tech 25**
  - 2.2%
  - 1.7%

**Occupancy Change Since 2010**

- **Tech 25 has recorded a sharper increase in occupancy**
  - 5.0%
  - 3.2%

**Absorption Since 2010**

- **Change in occupancy greater within the Tech 25**
  - 233
  - 116

**Rent Growth Since 2010**

- **Asking rents up much more within the Tech 25**
  - 29.4%
  - 11.0%

Tech cities have outperformed... but tech markets are cooling for now

**Vacancy Change Since Q1 2016**

Vacancy has actually ticked up in the Tech 25 recently

<table>
<thead>
<tr>
<th>Change in Vacancy</th>
<th>Tech 25</th>
<th>All Other Markets</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5%</td>
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<tr>
<td>-0.8%</td>
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<td>-0.6%</td>
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<td>0.8%</td>
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<tr>
<td>1.0%</td>
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**Absorption Since Q1 2016**

Change in occupancy has weakened in the Tech 25 over the past year

<table>
<thead>
<tr>
<th>Change in Occupancy</th>
<th>Tech</th>
<th>All Other Markets</th>
</tr>
</thead>
<tbody>
<tr>
<td>26 MSF</td>
<td></td>
<td></td>
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<tr>
<td>30 MSF</td>
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</tbody>
</table>

The primary tech markets – Silicon Valley, San Francisco – have been so red hot over the past six years that any slowdown would appear negative. These markets will continue to expand but in a more sustainable fashion.

CONCLUSION

TECH IS EVER-CHANGING...

Throughout 2017 and beyond, we will explore in more detail what makes a city a “tech city,” and what the industry expansion means for CRE. Our tech metrics critically analyze and explore key topics that impact the ingredients for a tech city.
Our goal is to keep a watchful eye on the interconnection between the tech industry and cities across the country, particularly in relation to CRE. Various reports to come include further detail on the top cities within this report as well as specific results from our U.S. Tech Survey sent to our markets, including commentary from market-leading experts.
About Cushman & Wakefield

Cushman & Wakefield is a leading global real estate services firm that helps clients transform the way people work, shop, and live. Our 45,000 employees in more than 70 countries help occupiers and investors optimize the value of their real estate by combining our global perspective and deep local knowledge with an impressive platform of real estate solutions. Cushman & Wakefield is among the largest commercial real estate services firms with revenue of $6 billion across core services of agency leasing, asset services, capital markets, facility services (C&W Services), global occupier services, investment & asset management (DTZ Investors), project & development services, tenant representation, and valuation & advisory. 2017 marks the 100-year anniversary of the Cushman & Wakefield brand. 100 years of taking our clients’ ideas and putting them into action. To learn more, visit www.cushwakecentennial.com, www.cushmanwakefield.com or follow @CushWake on Twitter.

About Cushman & Wakefield’s Technology Group

The technology industry is perhaps the most dynamic and constantly evolving – therefore, the real estate requirements surrounding this sector must also be flexible. The professionals in Cushman & Wakefield’s Technology Group share a deep understanding of the unique needs of early, mid, and mature stage technology firms, and are skilled in providing strategies and direction that align with a very unique set of business objectives. We help technology companies achieve their real estate goals today, while ensuring protections are in the place for growth. For dynamic industry news and to connect with one of our tech pros, please visit cushwaketech.com

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