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JLL Research Report

Tech Office Trends

JLL's Technology Research Group is pleased to present its seventh annual technology outlook. If you've been a reader of ours in years past, you'll notice a new look and a new story. Similar to the constantly innovating technology industry, we continue to think of new ways to present the latest research and what's most important to our readers. This year's report intends to highlight some of the biggest topics that are impacting the real estate decisions of technology companies across the country, and offer a glimpse into how this data can be tailored to your company's specific strategy.

Contributors

Amber Schiada
Director, Technology Research
+1 213 239 6141
amber.schiada@am.jll.com

Julia Georgules
Director, Technology Research
+1 617 316 6453
julia.georgules@am.jll.com

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Top 6 trends that will impact real estate decisions

1. Talent is the target

With more than seven years of economic expansion (the longest-running since post-WWII) under our belts, competition for the best and brightest people is at an all-time high. And with the economy trending toward at least another 18–24 months of additional growth, this competitive environment isn't expected to change. To prove our point, take a look at job openings. On the one hand, the numbers are very uplifting. Job openings hit a new record in October at 6.2 million, with no signs of a slowdown. On the other hand, low unemployment (4.2 percent) paired with low labor force participation (63.1 percent) remain hurdles for the economy at large, and employers are getting increasingly more creative. Because of this, we expect more secondary and tertiary markets to be the beneficiary of corporate expansions. This should continue to spur tech clustering and allow smaller startups to stay local in the future.

2. Cost is irrelevant

Well, that's not exactly true, and good financial decision-making is key to smart growth. But the future of work is changing, and making good investments in the workplace is becoming more and more critical to a company's success. The adage "it's all about location" is truer now more than ever, but equally critical to the real estate discussion is the human experience. Companies that embrace this philosophy by investing in the experience that they offer to employees can focus on three tenets of our Human Experience model: engagement, empowerment and fulfillment. When all three pillars are activated within a company, the effects on employee productivity, innovation and retention can be significantly improved. So while a nicer office, location and amenities may cost more, what a company will get in return is worth every penny.

3. Reversal of density

Over the course of both this economic cycle as well as this real estate cycle, trends toward efficiency have reigned supreme. From micro apartments to car sharing, to coworking and beyond, the drive toward a "less is more" ownership mentality on a personal and corporate basis has completely transformed the way things work. As a result, the concept of the personal office has been largely eliminated from a technology company's space design and personal workspace has been reduced from what was once an industry standard of 350 square feet per person during the dot-com days to as low as 50 square feet per person today. We all know the adage of "too much of a good thing" and early anecdotal evidence indicates that companies have become too efficient. While we knew that the all-open workplace was inhibiting productivity, the all-shared workspace also has its downside. Companies will be taking a closer look at the optimal space utilization ratios moving forward.

4.

Flexible space evolution

Coworking is here to stay whether you like it or not, because as it turns out, a lot of people like it. Companies are now setting up shop in coworking centers, placing teams small and large into these spaces for a variety of reasons. The "third space" will be considered the third pillar of sound real estate strategy, especially as companies consider these other trends mentioned. How do you attract and retain the best workforce, for the best cost, in the best market? And how can you consider the generational shift and prepare for that as well? Flex office options offer additional options on short notice, without sacrificing culture. Expect to see a blurring of lines between not only traditional coworking centers and the traditional office, but also hotel lobbies, coffee shops, retail banking centers and office common areas to serve as the third space informally as well.

5.

Generations matter

The baby boomers caused fundamental changes in our society that no one could deny. Millennials outnumber the boomer generation and the youngest of those are just now graduating high school (I know, youth is wasted on the young). Sure, all the first-wave millennials want to live in cool downtown lofts and ride their fixie to work, or do they? As millennials come of age, they will be buying homes. They will be settling down. They will be raising children. It may not look the same as their elders' generation, but they will need housing, and they will want to ease their work-life balance. What should companies be thinking about when considering long-term moves? The suburbs are not dead, and even though we've seen a lot of shift toward downtowns across the country, don't count the suburbs out just yet.

6.

Cost of living: A top concern

Housing is expensive, especially in markets that have benefited from booming economic conditions thanks to an expanding tech industry, California, New York City, Boston and now Seattle. It seems that young talent can't catch a break. New graduates are bunking up with multiple roommates, converting living rooms into bedrooms or renting micro apartments. Sure we all had to stretch when we got our first job, but in some cities it's just too much. Markets with the greatest tech job growth this cycle have also seen the greatest increase in the cost of living. How should you be thinking about this issue? Many a talented tech professional will remain in the top markets, but there are many more that want all of the quality of living without the cost. Since we already mentioned earlier that talent will remain the key target for companies, it'll also be important to understand where that talent wants to live.

The *tech* industry:
Commercial real estate's biggest customer

Over the course of this economic cycle there's been a lot of speculation about the tech industry's sustainability.

Is it a bubble or isn't it? Are the valuations crazy or are they the new norm? How can unprofitable companies continue to grow at such a rapid pace without presenting a risk to the economy and the real estate markets at large? How long can this continue?

These are all legitimate questions. Many people were burned during the dot-com bust, and the scars from that experience run deep. Since 2009, the technology industry, the venture capital industry and many of us in the commercial real estate industry have been assuring the economy that this is not a bubble.

We all say that it's different this time, and it is.

For starters, most of us have become dependent on the technologies that we worry are contributing to bubble conditions. And we aren't using these technologies (and others) any less. In fact, we're using them more.

As a result, the tech industry continues to be the largest consumer of office space across the country. They're gobbling up talent and large blocks where they can get them and driving economic growth from San Francisco to New York and everywhere in between.

These 2017 company expansions are notable not only because of the unabated demand for real estate, but also for the jobs that will be created in these new locations.

1. **Facebook**
New location: **San Francisco**
Size: **436,000 s.f.**
Estimated job creation: **TBD**

2. **Lyft**
New location: **Silicon Valley**
Size: **91,000 s.f.**
Estimated job creation: **TBD**

3. **Infosys**
New location: **Raleigh-Durham**
Size: **60,000 s.f.**
Estimated job creation: **2,000**

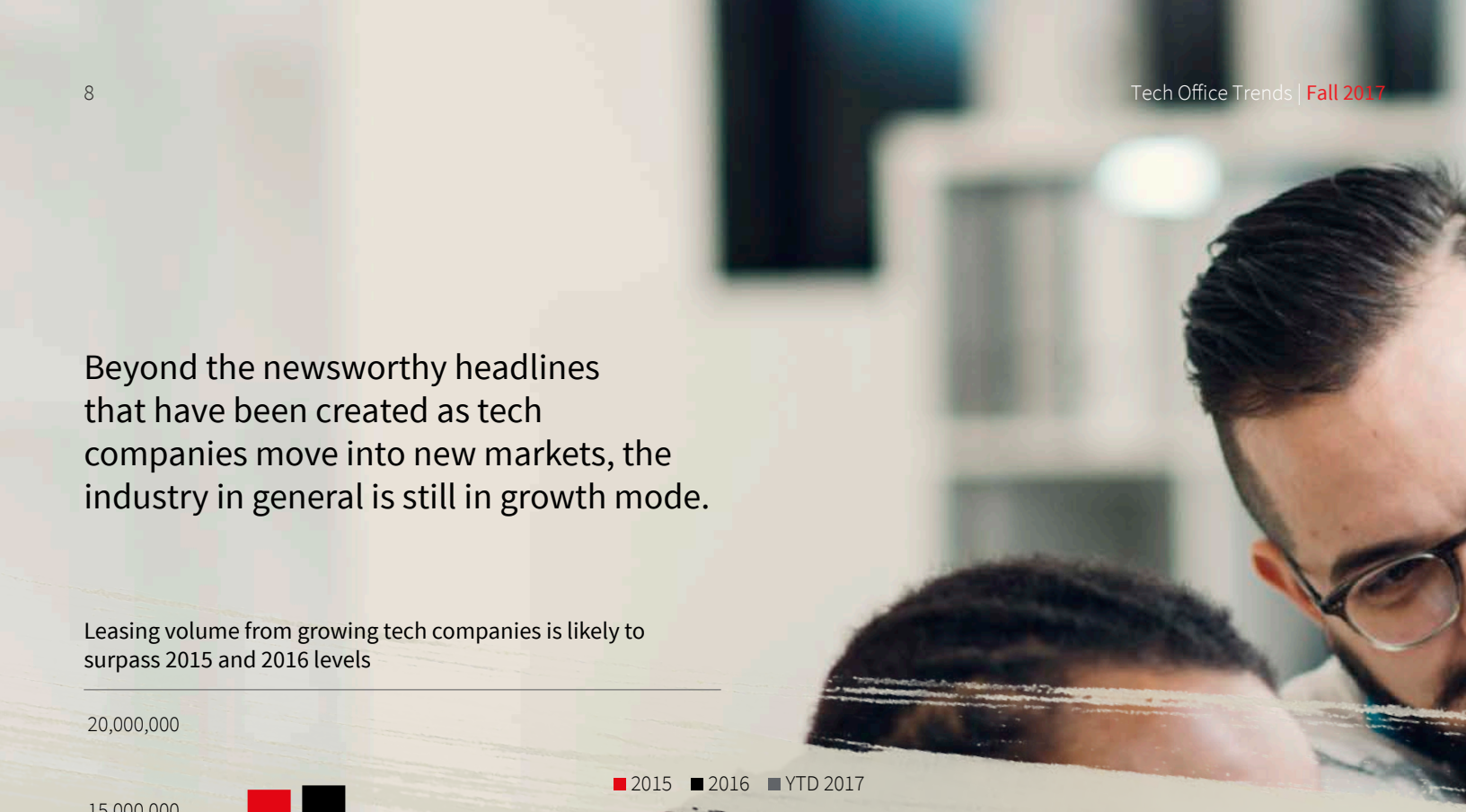
4. **Yelp**
New location: **Washington, DC**
Size: **54,000 s.f.**
Estimated job creation: **500**

5. **Airbnb**
New location: **Seattle**
Size: **43,000 s.f.**
Estimated job creation: **300**

6. **Upgrade**
New location: **Phoenix**
Size: **38,000 s.f.**
Estimated job creation: **300**

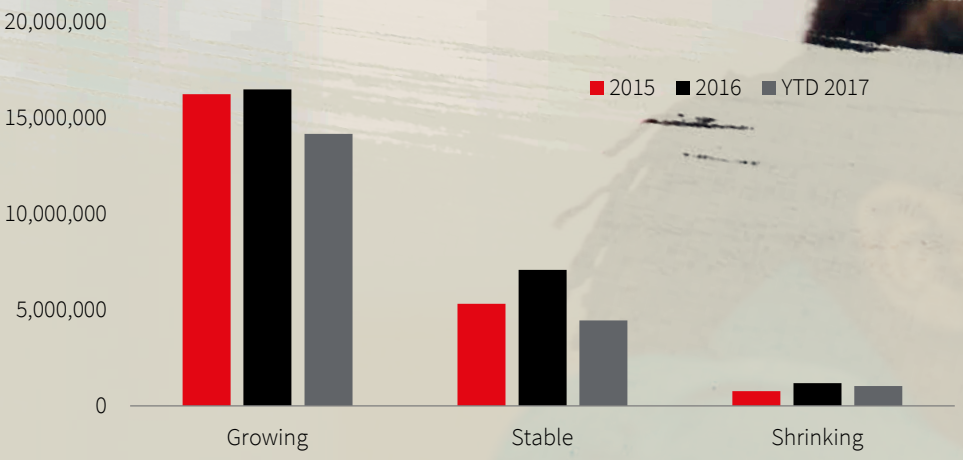
7. **Shure**
New location: **Chicago**
Size: **35,000 s.f.**
Estimated job creation: **150**

8. **Tsunami ARVR**
New location: **San Diego**
Size: **32,000 s.f.**
Estimated job creation: **200**

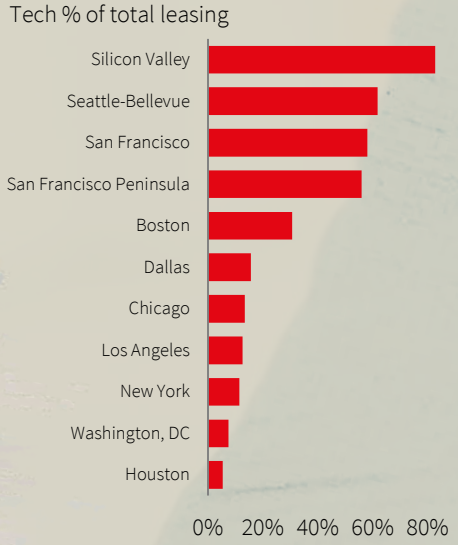


Beyond the newsworthy headlines that have been created as tech companies move into new markets, the industry in general is still in growth mode.

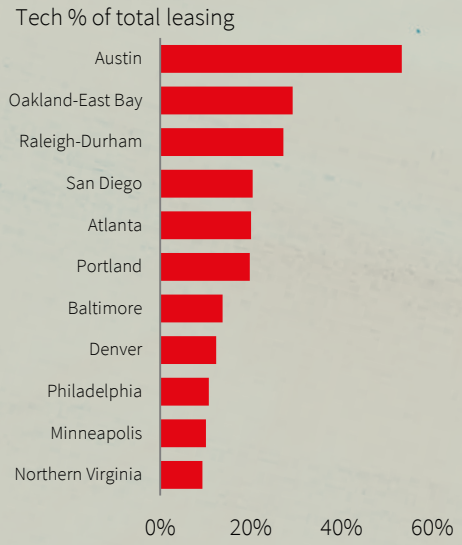
Leasing volume from growing tech companies is likely to surpass 2015 and 2016 levels



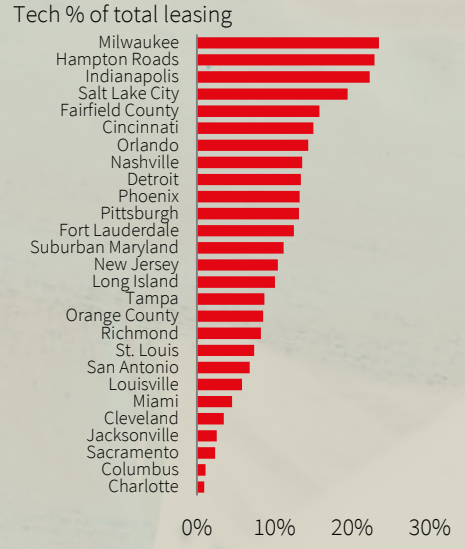
West Coast tech hubs remain the most saturated with tech leasing activity among primary CRE markets



Secondary tech markets are less exposed to tech but could see more activity in the coming years



Emerging tech markets still remain diverse leasing markets compared to primary and secondary tech hubs



**Represents leases of 20,000 square feet or more signed since Q3 2014*

So is this a bubble? Nope.

It's an economic revolution. It's a complete shift in our economy toward innovation, technology, mobility and agility. The proof is in the industry's permeation into markets across the country, not just the major tech hubs. There are some who would argue that in the face of a downturn the tech industry retreats from these smaller tech markets. But why? As stated above, our economy has undergone a complete transformation, and it's not done yet. We expect it to continue everywhere to varying degrees.

What does this mean for tech companies?

Unlike the tech industry of the dot-com days, today's tech companies have many more viable location options to consider. Urbanization trends have lent nicely to the growth of tech clusters everywhere, as more of the workforce chases new markets for lifestyle and cost of living, and employers chase talent to those markets.

San Francisco has been one of the biggest beneficiaries during this cycle. While the city was always considered a tech hub, prior to 2009, it was not viewed as a market capable of housing a large headquarters location. For that, a company had to move to Silicon Valley. Seattle is another great example, with tech growth transforming the city over the last decade despite a suburban legacy in Redmond, thanks to Microsoft.
It's happened in smaller markets as well, resulting in niche specializations like fintech in Atlanta or robotics in Pittsburgh, to name a few. And while the suburban tech campus is still alive and well in major tech hubs, it's no longer the only way to grow. So what this volume of leasing activity really tells us is that the industry is not just growing and planting roots, it's becoming a more integrated part of the fabric of a local economy.

What does this mean for owners and investors?

For the investor community keen on capturing a fast-growing or brand-name tech tenant, it means that they no longer have to look solely to the Bay Area. They can now ride this tech wave in virtually any market.

But buyers beware. Current and recent leasing trends may show attractive tech growth, but the promise of this rate of growth continuing 24 or 36 months from now is unlikely given current and future employment conditions. With unemployment at historic low marks, the ability for a tech company (or any company) to grow the way it was able to over the previous 10 years is becoming increasingly more difficult. Because the tech industry has been one of the few industries responsible for organic occupancy growth across markets, it means that additional rent growth will become harder to achieve.

Investors should not be concerned over the long term, though. With tech permeating virtually every local economy, the outlook for many metro areas is a promising one.

What's that *cool space* going to cost you?

A lot of concepts are taking hold in tech offices across the country. We break down the top three recurring trends.

1. A place to keep employees happy.

The number one trend in the tech office sector is thoughtful design for employee engagement and happiness. As tech companies compete to attract and keep talent, every decision comes back to boosting employee satisfaction. Savvy tenants are consistently implementing new features and services within their office space to keep the workplace cheerful, from slides and lounges to endless freebies.

Successful examples:
Fully catered cafes and lunch rooms, wide selection of "choose-your-own" work spaces, on-site IT "genius bars," fully equipped roof decks and outdoor plazas, game rooms and even company-scheduled on-site fitness classes.

2. Spaces designed with employees in mind.

Building off of employee happiness, tenants in engaging office spaces have spent a tremendous amount of time and effort designing their spaces to be both functional and responsive for occupants. Many tenants spend a significant amount of time interviewing employee teams about what they want out of their new space, and design the office with an employee-first mentality (versus the "one-size-fits-all" approach), catering to employees' strengths and team dynamics.

Successful examples:
Team-specific space layouts based on needs and atmosphere, foot traffic planning to encourage "random encounters," a range of collaborative spaces—mini to mega—and the ability for teams to customize their area with equipment as they see fit, whether it be videoconferencing units, electronic whiteboards or even phone booths.

3. Flexibility and mobility—a must-have.

In the tech office today, nearly every tenant requires high levels of mobility and flexibility in their office space, to cater to their fast-paced and collaborative business models. This mantra has played out in several ways across office buildouts but is predominantly seen in the surge toward universal benching and flex-use spaces. The open space plan and range of double-use spaces make the modern tech office equipped to handle nearly any situation, from employee one-on-ones to a 700-person IPO party.

Successful examples:
Office plans with 100 percent mobile benching, fully transformable spaces with movable acoustic walls, "un-rooms" (three-sided standing conference rooms) and, of course, the ability to arrange an 'all-hands space' for several hundred employees to gather.

Markets by the numbers: Tech fit-out

Total costs and tenant improvement allowances for a tech office space

Market	Tech fit out cost	Average TI package	Tenant out-of-pocket	% Premium over U.S. Avg.
Atlanta	$157.08	$60.00	$97.08	-22.6%
Austin	$150.50	$20.00	$130.50	4.1%
Baltimore	$162.73	$43.25	$119.48	-4.7%
Boston	$185.45	$50.00	$135.45	8.0%
Charlotte	$153.48	$25.00	$128.48	2.5%
Chicago	$190.80	$75.00	$115.80	-7.6%
Cincinnati	$157.49	$40.00	$117.49	-6.3%
Cleveland	$165.51	$20.00	$145.51	16.1%
Columbus	$160.47	$20.00	$140.47	12.0%
Dallas	$154.20	$20.00	$134.20	7.0%
Denver	$159.55	$65.00	$94.55	-24.6%
Detroit	$170.75	$20.00	$150.75	20.2%
Fairfield County	$177.23	$47.50	$129.73	3.5%
Fort Lauderdale	$151.53	$35.00	$116.53	-7.1%
Fort Worth	$151.63	$40.00	$111.63	-11.0%
Hampton Roads	$154.61	$19.50	$135.11	7.8%
Hartford	$176.20	$25.00	$151.20	20.6%
Houston	$154.20	$65.00	$89.20	-28.9%
Indianapolis	$160.98	$25.00	$135.98	8.5%
Jacksonville	$150.50	$30.00	$120.50	-3.9%
Long Island	$196.76	$35.00	$161.76	29.0%
Los Angeles	$183.19	$70.00	$113.19	-9.7%
Louisville	$157.08	$40.00	$117.08	-6.6%
Miami	$150.91	$40.00	$110.91	-11.5%
Milwaukee	$172.40	$45.00	$127.40	1.6%
Minneapolis	$175.58	$55.00	$120.58	-3.8%
Nashville	$154.71	$32.00	$122.71	-2.1%
New Jersey	$185.15	$45.75	$139.40	11.2%
New York City	$205.92	$70.00	$135.92	8.4%
North S.F. Bay	$187.51	$47.00	$140.51	12.1%
Northern Virginia	$162.53	$70.00	$92.53	-26.2%
Oakland – East Bay	$193.89	$60.00	$133.89	6.8%
Orange County	$180.01	$50.00	$130.01	3.7%
Orlando	$152.35	$40.00	$112.35	-10.4%
Philadelphia	$184.43	$50.00	$134.43	7.2%
Phoenix	$156.56	$25.00	$131.56	4.9%
Pittsburgh	$171.47	$40.00	$131.47	4.9%
Portland	$169.83	$35.50	$134.33	7.1%
Raleigh Durham	$153.74	$45.00	$108.74	-13.3%
Richmond	$159.74	$40.00	$119.74	-4.5%
Sacramento	$183.81	$20.00	$163.81	30.7%
Salt Lake City	$158.72	$40.00	$118.72	-5.3%
San Antonio	$152.45	$40.00	$112.45	-10.3%
San Diego	$179.49	$60.00	$119.49	-4.7%
San Francisco	$200.47	$60.00	$140.47	12.0%
Seattle	$174.66	$55.00	$119.66	-4.6%
Silicon Valley	$194.50	$50.00	$144.50	15.3%
St. Louis	$171.37	$30.00	$141.37	12.8%
Suburban MD	$162.01	$57.00	$105.01	-16.2%
Tampa	$152.76	$35.00	$117.76	-6.1%
Washington, DC	$180.75	$95.00	$85.75	-31.6%
West Palm Beach	$149.78	$35.00	$114.78	-8.4%
Westchester County	$192.65	$50.00	$142.65	13.8%
National average	**$168.91**	**$43.54**	**$125.37**	**0.0%**

Source: JLL Research, JLL Project and Development Services Business Intelligence

Where did this data come from?

The fit-out costs for each market depict the average expenses of building out a comparable tech office across the country and take into account the unique cost elements of each city. These totals were created by compiling nearly 200 JLL Project and Development Services–managed tech tenant projects, and they paint a comprehensive picture of the average amount a tenant will pay for a new office space. While many factors can affect the final budget, including materials selection, existing space conditions and layout design, these costs provide a midpoint scope and take into account:

- Hard costs
- Design + fees (soft costs)
  - Architecture, engineering, project management, consulting and additional fees
- Furniture, fixtures and equipment (FF&E)
- Tenant factors
  - Audio/video installation
  - Security costs
  - IT and technology costs
  - Moving fees
- Contingency

How costs match up: Tech versus office fit-out

	Tech Office	Traditional Office	Cost Difference
Hard costs	$ 77.11	$ 98.25	-$21.13
Design + fees	$ 16.36	$ 25.15	-$8.79
FF&E	$ 30.00	$ 27.51	$2.49
Tenant factors	$ 28.30	$ 27.71	$0.60
Contingency	$ 15.18	$ 17.88	-$2.70
Total	**$ 166.95**	**$ 196.49**	**-15.0%**

When looking at the national average cost to build out both a traditional and a tech-focused office space, the differences can be surprising but confirm what many are already thinking.

1. When all is said and done, a tech office is 15 percent cheaper than traditional spaces.

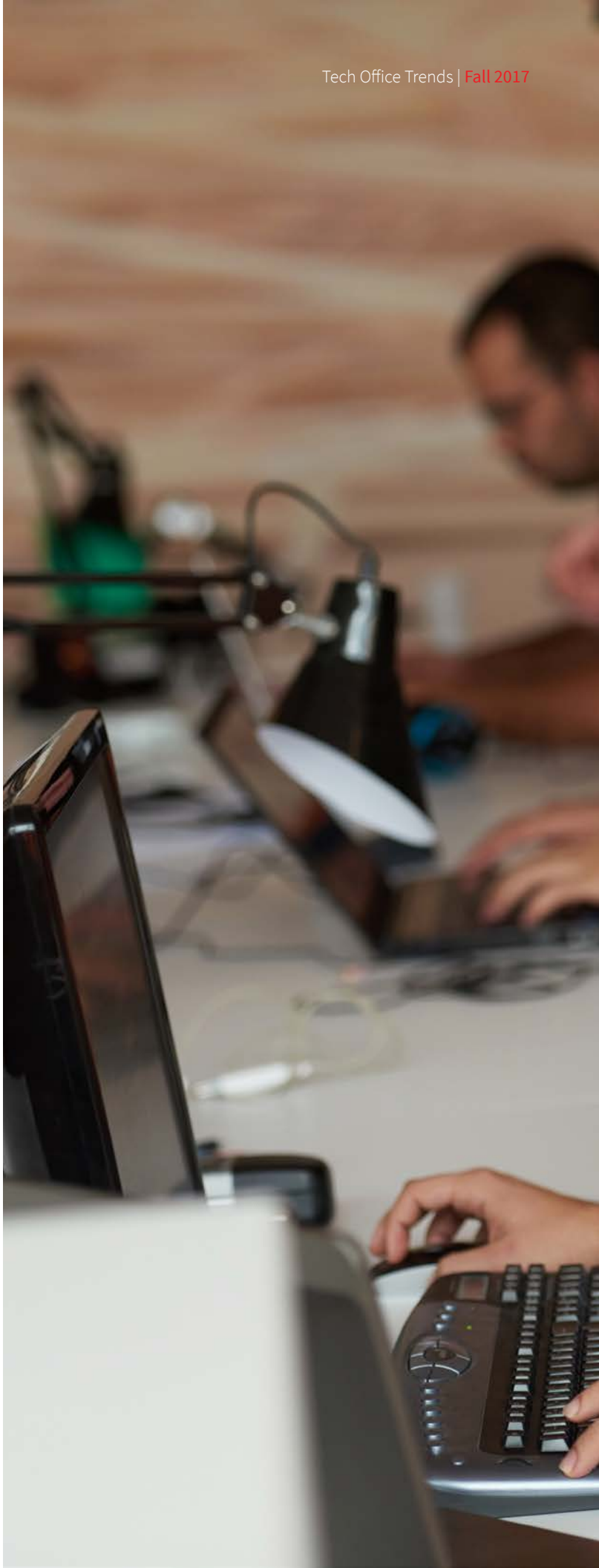
After taking into account the full picture of building out a tech office, tenants can expect to pay 15 percent less than a comparable traditional office suite, or nearly $30 per square foot less. However, while tech tenants typically save on physical construction, they traditionally spend a bit more on furniture, audio/visual and technology amenities.

2. Hard costs and materials are 21 percent lower in tech fit-out budgets than traditional offices.

While traditional workspaces tend to have a higher density of private offices, the tech office minimizes the private office count in favor of common areas, quiet spaces and meeting rooms—shrinking the amount of physical materials that need to be purchased and installed, cutting over $20 per square foot. Fewer private offices also saves on design and other associated fees.

3. Furniture, technology and audio/visual equipment—larger line items for tech tenants.

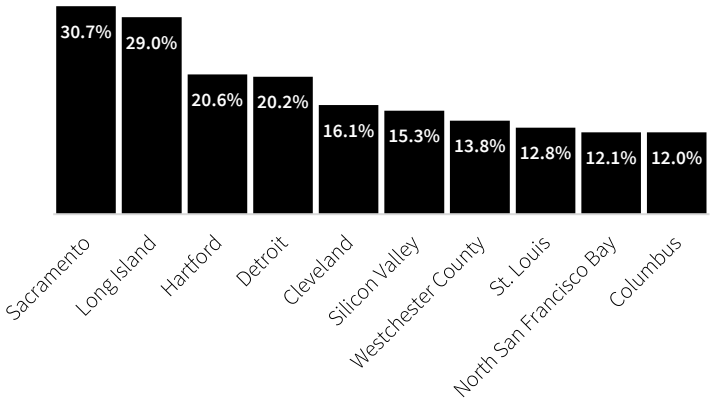
While tech office fit-outs can save a bundle on hard costs, tenants can sometimes pay upward of $50 per square foot to equip the office, which can be significantly higher than traditional users. Tech tenants tend to have higher standards for technology components and are more likely to have a higher spend on equipment such as projectors, smart TVs, videoconferencing and other high-tech gear.



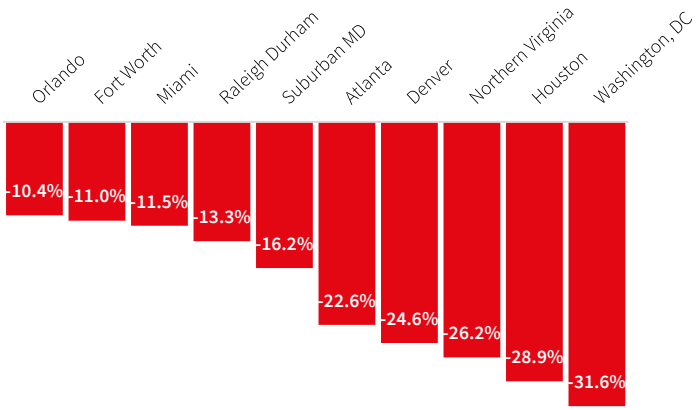
When looking at the cost tech companies can expect to pay out of pocket to fit-out office space, landlord-provided tenant improvement allowances (TIs) have a huge impact on the final cost. Essentially, a low TI allowance in a given market means that tenants are expected to pay more out of pocket for their fit-out, and vice versa. Ultimately, TI allowances can vary significantly market by market, and can have a key role in budgeting a given project. Proof of point, we can look at landlord-funded TI allowances in Washington, DC ($95 p.s.f.) versus Sacramento, CA ($20 p.s.f.)—a significant gap, and one that actually makes it cheaper to fit-out a tech office in DC than one in Sacramento. A little surprising, right?

When looking at the top markets by the premium a company can expect to pay to fit-out a tech space over the U.S. average, and taking into account both local costs of construction and market-specific TI allowances, the results can be surprising.

Top markets by % premium over U.S. average



Top markets by % premium below U.S. average



Innovative workspace examples

JLL Project and Development Services has managed many projects that put the trends mentioned earlier into action. Here are three case studies on cutting-edge tech spaces covering high-, standard-, and base-level fit-outs.

- by Mason Mularoni
Senior Research Analyst, PDS and Industry Research

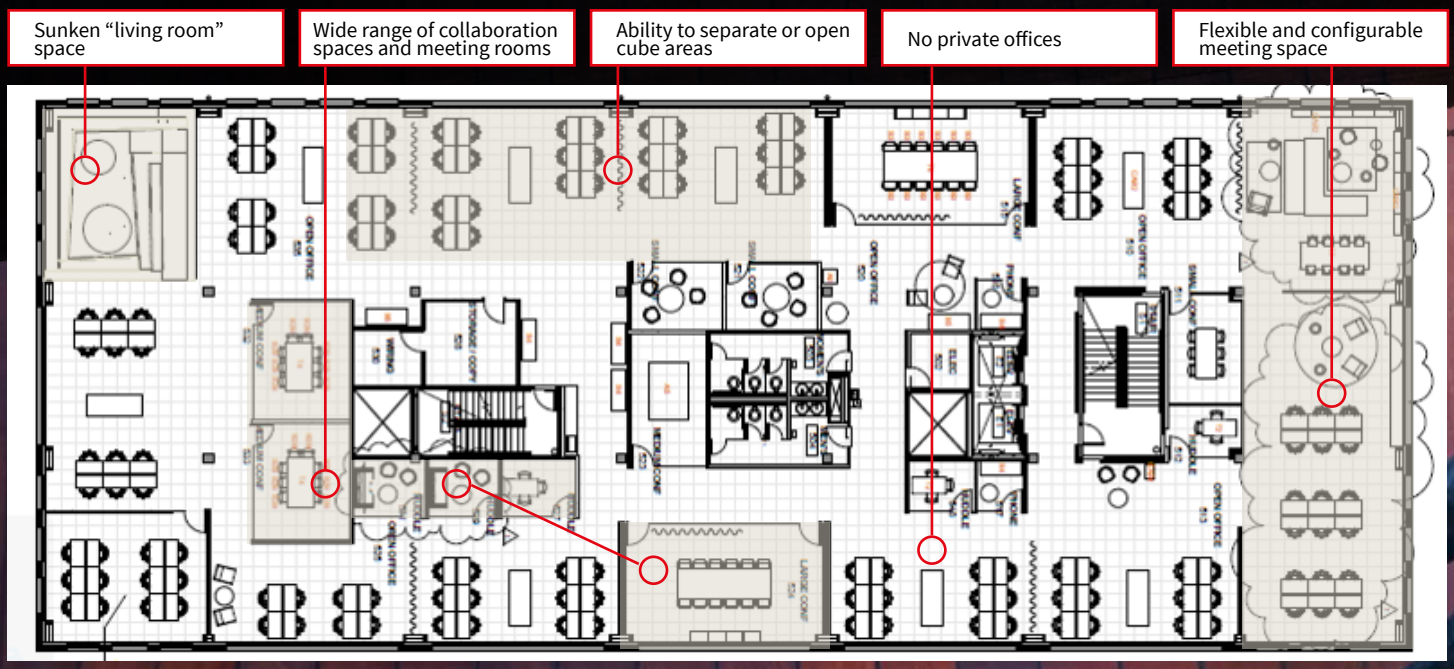
High-level fit-out

Tenant: **Simple**
Industry: **Fintech**
Location: **Portland, OR**
Total square footage: **50,000+**
Seating density: **170 s.f./person**

Tenant needs:
An office space directly suited to Simple's core ideals that allowed for rapid expansion, was designed with employees in mind and encouraged them to enjoy their work and fellow employees.

Delivered space:
A highly interactive and flexible space that could be transformed to meet whatever the company's needs were at any point in time. Simple's new office includes a host of amenities catering to employee health and well-being, as well as productivity and engagement. Simple and JLL spent an incredible amount of time understanding the needs of employees and teams, and designing personalized space that catered to the needs of each individual group.

Unique factors:
- Sunken "living room" workspaces
- Game room and bar
- Fully connected roof deck
- Master stair connecting all floors
- Extremely open floor plan, with thoughtful acoustic-deadening materials
- Full gamut of technology components



Standard-level fit-out

Tenant: **Twilio**
Industry: Software & Communications
Location: San Francisco
Total square footage: 80,000+
Seating density: 130 s.f./person

Tenant needs:
An office space capable of handling several hundred employees that was well equipped for a fast-moving technology company and fostered communication in a collaborative environment.

Delivered space:
Twilio's new space succeed on all fronts, as it effectively housed the robust staff while instilling collaboration across teams in an incredibly functional space. The very open floor plan utilizes an array of meeting spaces and collaboration zones to break up the teams while keeping an open atmosphere.

Unique factors:
- Centrally located "Genius Bar" for IT assistance and products
- Transformable all-hands space capable of housing several hundred employees at once
- "Un— rooms" – three-sided standing conference rooms with no door
- A cost-engineered high-tech and innovative office, within a reasonable budget

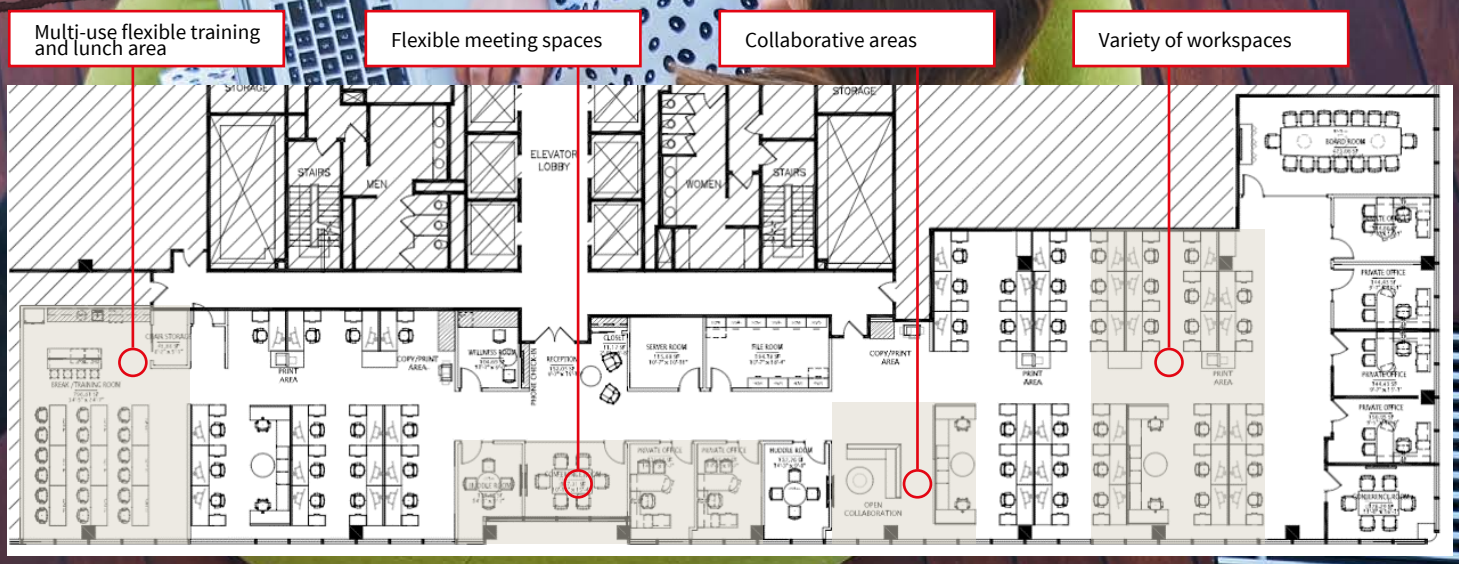
Base-level fit-out

Tenant: **Harris Computer**
Industry: Software
Location: Chicago
Total square footage: 10,000+
Seating density: 160 s.f./person

Tenant needs:
A simple office space with minimal requirements, packed into an effective and affordable budget.

Delivered space:
Harris Computer's new office is basic and straightforward space with minimal frills but built for an affordable price. The new office space utilizes an open floor plan with a handful of private offices mixed throughout. While the space is simple, it effectively engages employees in a collaborative environment.

Unique factors:
- Straightforward tech office on an affordable budget
- Simple tech usage
- Open space, but encourages engagement
- Flexible-use lunch and training room



Flex office or work from home?

What's right, what's wrong?

- by Scott Homa
Director, Office Research

Workforce mobility has changed the dynamics of the office market.

Today there is more fluidity in terms of space use and the time and place in which work is performed. Remote work has grown to encompass many destinations — from home offices to coffee shops and, increasingly, coworking locations such as WeWork. Adoption of the coworking model has grown a lot in recent years, ranging from freelancers and startups to global corporations. The tech sector has been an early adopter of this concept, with companies such as Airbnb, Facebook, Microsoft and IBM leveraging the coworking model with enthusiasm.

Coworking has become an attractive option for tech companies for a variety of reasons:

- Lowering initial out-of-pocket expenses compared to traditional leases
- Providing swing space for short-term needs
- Serving a temporary or contract workforce
- Changing company culture to emphasize more face-to-face collaboration
- Accommodating business travelers with convenient drop-in options
- Reducing administrative and support staff costs associated with satellite offices
- Providing greater speed-to-market for time-sensitive space requirements

Companies have also been drawn to coworking as a way to better manage their remote workforce, increase innovation and recruit and retain talent. Coworking arrangements may foster innovation through more personal interactions, exposure to new business concepts and sharing of ideas. Leveraging a coworking platform can help with workforce management and improve the employee experience, allowing for more socializing and collaboration. In some cases, it may reduce commute times.

Recruiting an employee to work in a coworking space requires different management with a focus on corporate culture, which can present challenges. But offering coworking as an option to prospective and existing employees can be seen as a strong selling point. For those individuals, particularly those who would otherwise work from home or endure a long commute to get to the office, the option of coworking may be viewed as a compelling benefit. Additionally, for companies, the coworking network in many locations may provide a pipeline for talent, especially for tech companies that are seeking a young, creative and digitally savvy workforce.

While coworking may enable tech companies to recruit digital talent or begin a cultural transformation, a critical component of leveraging coworking to achieve these objectives is the connectivity to the broader enterprise. In many cases, coworking provides an interactive, community-focused experience for employees; but that experience won't benefit the broader culture if done in isolation or if it's pushed on business units that perform more focused, heads-down work. For that reason, many corporate users are opting to incorporate some of the design elements of coworking into their broader workplace strategy, providing an experience that can facilitate cultural transformation, while keeping more traditional elements of the workplace to serve a range of employees.

Is coworking right for you?

Coworking has presented a solution to this startup dilemma, offering a pay-as-you-go alternative to traditional office space. More tech companies are flocking to flexible space providers as they scale up from coffee shop to full-tilt lease. Regardless of where a tech company may be within its life cycle, coworking may help solve some of their most pressing business challenges, including:

Cost reduction
Challenge: High initial capital expenditures and average utilization rates ranging from just 50 to 60 percent for most tenants creates cost inefficiencies.
Opportunity: Adoption of coworking solutions can reduce initial out-of-pocket costs, enable greater efficiency and potentially drive down total occupancy costs.

Talent management
Challenge: Only 40 percent of employees feel fully engaged in their current workplace format.
Opportunity: Leveraging a coworking platform can help companies better match their real estate needs with the needs of their workforce, improving the employee experience, enabling more collaboration and potentially reducing commute times.

Collaboration and innovation
Challenge: In this day of "digital nomads," companies are seeking ways to drive innovation and collaboration.
Opportunity: Coworking arrangements may foster innovation through increased employee interaction, exposure to new business concepts and sharing of ideas.

Flexibility
Challenge: Most organizations only have 24 months or so of revenue projections and strategic plans.
Opportunity: Flexible space options can help organizations "buy time" as they launch new initiatives, establish growth projections and develop longer-term real estate strategies.

While coworking offers all sorts of benefits, there are still a few potential drawbacks to consider.

Understanding the value proposition
Although coworking is often the most simple and affordable space option for individuals and small groups, as users achieve scale and accrue more time at a single location, the per-square-foot occupancy costs of flexible space arrangements may exceed traditional lease models.

Protection of intellectual capital
In addition to cybersecurity risks, the communal nature, open design and glass-heavy buildouts of most flexible space locations could inhibit the safeguard of intellectual property.

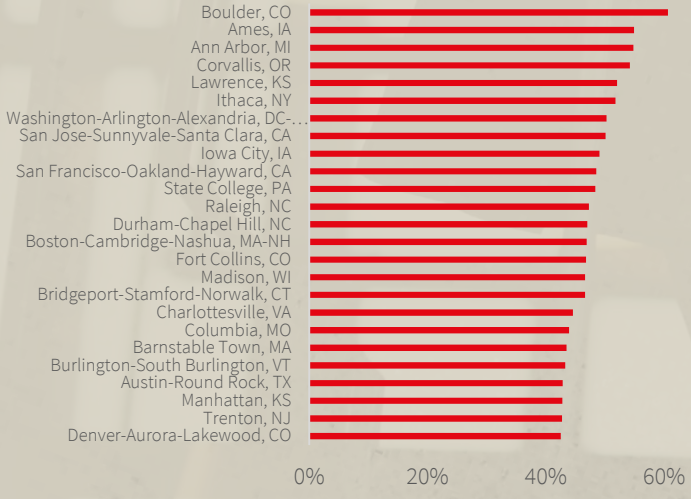
Employee productivity
Although a group of employees working together within a flexible space environment could stimulate collaboration and facilitate greater supervision of a mobile workforce, companies must also be mindful of flexible space's potential distractive influences and impact on productivity.

Cultural and strategic fit
Companies must assess whether flexible workspace is accretive to their culture and compatible with their broader business strategies, especially as it relates to recruitment and retention of talent.

Degree of *talent*

Although famous college dropout stories have become a badge of honor in the technology industry, maintaining a highly skilled workforce remains one of the most important strategies for tech companies today and for the foreseeable future. However, in recent years, sourcing that talent has become more challenging. As of November 2017, unemployment was 4.1 percent nationally, and for those with bachelor's degrees, it's just 2.0 percent. To add to that pressure, job openings in November hovered at a historically high rate of 6.1 million--16 percent higher than the highest level recorded in 2001 and 32 percent higher than the highest level recorded in 2007. Needless to say, it's a job-seeker's market and hiring companies are getting smart about talent pools across the country. While MIT and Stanford have long been perpetual talent factories on the East and West Coasts, many metro areas across the country boast a highly educated workforce.

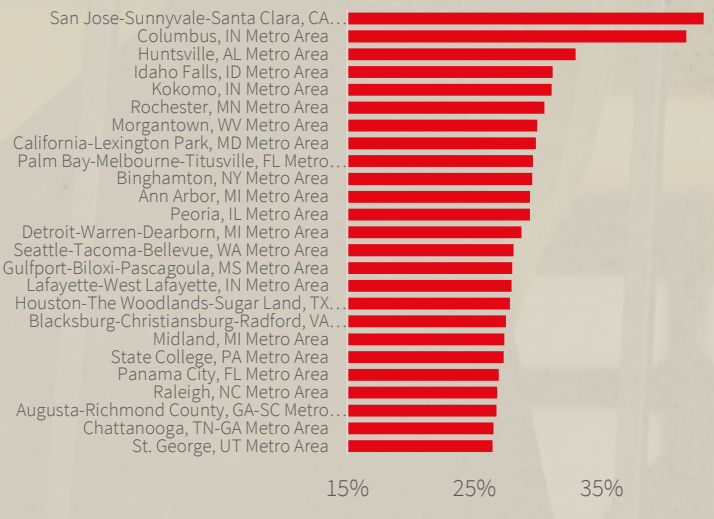
Below are the top 25 markets with the highest rates of educational attainment



Source: U.S. Census Bureau Note: Includes associates degree holders or higher

Taking a look at the list on the left, some well-known tech hubs stand out: San Francisco, San Jose and Boston. But there are other interesting trends. First, three of Colorado's metro areas rank in the top 25, likely due not only to local talent but also to migration from people across the country seeking its high-quality lifestyle. As a result, Lockheed Martin, Oracle, IBM and many more companies have significant beachheads in the Rocky Mountain state.

Top 25 markets with the highest rates of science and math degrees (as a share of all bachelor's degrees)



Source: U.S. Census Bureau

However, like any technical field from legal to medical, the technology industry can't rely on high levels of educational attainment alone. They need specialists in the field of computer science, and those are harder to come by, so understanding where talent pools exist is an important consideration. Looking at the top of this list, one will not be surprised. The San Jose–Sunnyvale–Santa Clara metro, better known as Silicon Valley, has the highest rate of adults 25 years and older with

degrees in science and math—nearly half of all bachelor's degree holders. Unsurprisingly, the Seattle metro also makes the cut, no doubt led by people working in e-commerce and for Microsoft, among many more.

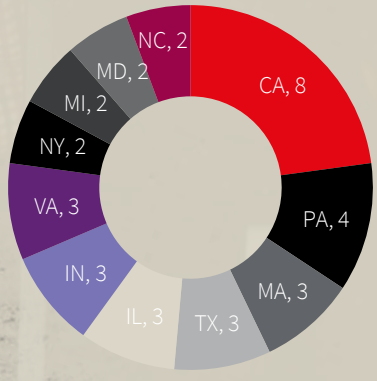
Other interesting markets also show up, including Huntsville, Alabama, home of NASA's Marshall Space Flight Center and Cummings Research Park, the second-largest research park in the country. The California–Lexington Park metro in Maryland is also a technology-driven area through the government's Patuxent River Naval Air Station, which employs roughly 20,000 people. And Ann Arbor is home to the University of Michigan, which offers both undergrad and graduate degrees in computer science and engineering. It's an interesting enclave of innovation, where Thomson Reuters, ProQuest and the Toyota Technical Center employ a combined total of more than 2,000 people.

A new focus on STEM in higher education

With demand for skilled labor in technical fields only increasing, it's not surprising that wages in STEM fields are more competitive. According to a Bureau of Labor Statistics report from January 2017, wages for STEM jobs were nearly double those of non-STEM occupations. During an economic cycle that's been characterized by low wage growth, these prospects are enticing to the future workforce, and more and more schools are beginning to offer coursework and degrees in computer science to meet this demand.

According to a list prepared by College Choice of the top 50 undergraduate degrees in computer science, the most well-known schools top the list, including University of California, Berkeley and MIT, but many other college towns and cities boast some impressive programs through the likes of Georgia Technical Institute, Michigan State University, Ohio State University and others. However, concentration of these programs on a statewide basis depict an interesting focus on innovation that's both publicly and privately supported through higher education. Certain states offer more of the "top" programs over others.

Number of top-rated computer science degrees by state



Source: College Choice

Six of the University of California's campuses topped the list along with Stanford and California Institute of Technology, which supports its powerhouse status as the dominant state for the industry. However, given California's sheer size when compared to the rest of the country, an impressive list of contenders join its ranks. Pennsylvania offers a mix of both private and state schools focused on tech and innovation, and the fruits of those labors have been enjoyed by the growing robotics industry in Pittsburgh. Massachusetts is obviously known for MIT and Harvard and its many famous innovations and alumni, but University of Massachusetts, Amherst is also bolstering the state's talent pipeline. Over the course of this entire economic cycle, Texas has enjoyed incredible population growth as well as employment growth and continues to pump its talent pipeline with graduates from Rice University, Texas A&M and well-known tech school University of Texas, Austin. But these are just a few examples. Talent and the focus on educating that talent can be found through many more university and college programs and in many more states.

Final thought

In an industry characterized by speed and scale, hiring for fast growth has been a challenge in recent years. As a result, many companies have been aggressively growing in markets outside of the usual tech hubs, understanding that now more than ever they must go to the talent. Finding the right market is a difficult decision though, for any industry but especially for tech. To help in the process, looking to future talent pipelines through universities is a good place to start and the reason for the two most well-known tech hubs' success in Palo Alto (Stanford) and Cambridge (MIT). But as mentioned above, there are many other universities to consider, and depending on a school's specialization, the right location could be a lucrative decision for future innovation. From driverless cars to electronic currencies and beyond, the next big thing in tech might still be in school.

Ranking

Data makes the world go 'round: Where does your market stack up?

Everyone loves a good top 10 list, right? We love them, too.

This year's tech ranking takes into account a number of factors that we explore in our annual report. What makes a market tick? What drives an innovative economy, and what metrics should we use to have a better look around the corner? Our ranking model aims to answer the question, which markets are leading the pack in terms of innovative growth potential? We looked at 22 variables stretched across six major categories, and weighted them accordingly to come up with our top ten list.

30%
Market momentum
How many people are employed in tech occupations, and how fast is that growing? We also look at wages here, where more growth is an indication of more demand for tech talent, and thus more momentum.

30%
Educated population
It's one thing to know how many people older than 25 have a bachelor's degree or higher (and we do), but it's even more powerful to know how many of those grads actually have a STEM degree. We did the digging, and this year's ranking includes this important stat, one that is going to be especially important as university hubs continue to be a primary driver of innovative cities.

15%
Innovation
We wanted to hone in on patents because that's one of the most concrete ways to get down to the bottom of just how innovative a market really is. Some of the top markets for patent generation are driven by the HQs of major tech companies in these markets, and some of it's driven by education centers.

10%
Population mix
Millennials get all the attention, but what about Gen X and younger boomers still in the workforce? We parsed the generational data to get better insight on the diversity of the workforce. A good mix ensures a better mix of talent, and experience still matters. We also weighted the size of the population, because a larger metro area supplies the greatest proportion of talent and also provides a great marketplace for the next big thing.

7.5%
Transit-oriented workforce
We believe that smart cities are the way of the future. Examining the resident population's preferred modes of transportation is a great indicator for just how dense and transit-forward these cities are. Markets where more people take modes other than automobile are factored in here.

7.5%
Cost
As people continue to move into cities across the globe, costs are rising, especially in top tech markets. But many of these cities are developing additional transit and housing, and working with communities to solve these problems. And while office costs may not be a top concern for tenants, housing costs are. The higher-priced markets weigh negatively in our model.

This is our official JLL tech office market ranking, taking into account all the ranking factors and weighing the data points accordingly. But you can also create your own rank based on the factors that you think are most important for your company.

Interested in building your own model? Contact us to find out how.

Top 10 tech office markets by rank and weighted market score

San Jose-Sunnyvale-Santa Clara, CA	84.3
New York-Newark-Jersey City, NY-NJ-PA	77.5
San Francisco-Oakland-Hayward, CA	74.3
Seattle-Tacoma-Bellevue, WA	67.8
Washington-Arlington-Alexandria, DC-VA-MD-WV	66.3
Chicago-Naperville-Elgin, IL-IN-WI	65.6
Boston-Cambridge-Nashua, MA-NH	65.0
Los Angeles-Long Beach-Anaheim, CA	64.0
Atlanta-Sandy Springs-Roswell, GA	62.1
Dallas-Fort Worth-Arlington, TX	61.2

What's clear in this list is that the markets where we've seen the most growth and the greatest steps toward more innovative economies are also the ones where tech companies have been flocking for the last five years.

There is enough growth to go around for everyone, though. University-anchored towns came up high in many of the individual category rankings, like Ann Arbor, Michigan, which has the second-largest number of STEM degree holders as a share of the 25+ population, second only to Silicon Valley. The McAllen, Texas, area came in on top for five-year patent growth, clearly a sign that the energy industry has been one of the more innovative sectors in this cycle.

All markets have the potential to foster innovation and tech industry growth. University centers have the greatest potential, and many of those markets ranked high among the smaller markets in many of the categories. Palo Alto and MIT have long been the reason for the success of Silicon Valley's and Cambridge's tech economies. As all industries continue to innovate and incorporate new tech into their business models, more and more markets will need to foster the development of an innovative workforce to support that.

Rankings:
Tech talent by the numbers

Top 10 tech labor markets

	Total employed in tech occupations
New York-Newark-Jersey City, NY-NJ-PA	289,130
Washington-Arlington-Alexandria, DC-VA-MD-WV	223,490
Los Angeles-Long Beach-Anaheim, CA	161,410
Chicago-Naperville-Elgin, IL-IN-WI	149,500
Dallas-Fort Worth-Arlington, TX	139,740
San Francisco-Oakland-Hayward, CA	135,380
Boston-Cambridge-Nashua, MA-NH	133,660
San Jose-Sunnyvale-Santa Clara, CA	130,550
Seattle-Tacoma-Bellevue, WA	125,650
Atlanta-Sandy Springs-Roswell, GA	114,580

Markets ranked by greatest absolute gain in tech employees 2011–2016

	Total employed in tech occupations	Greatest 5yr growth
New York-Newark-Jersey City, NY-NJ-PA	289,130	45,700
San Francisco-Oakland-Hayward, CA	135,380	44,850
Chicago-Naperville-Elgin, IL-IN-WI	149,500	43,200
San Jose-Sunnyvale-Santa Clara, CA	130,550	38,680
Atlanta-Sandy Springs-Roswell, GA	114,580	33,840
Dallas-Fort Worth-Arlington, TX	139,740	32,760
Seattle-Tacoma-Bellevue, WA	125,650	26,070
Phoenix-Mesa-Scottsdale, AZ	76,340	24,710
Los Angeles-Long Beach-Anaheim, CA	161,410	23,370
Charlotte-Concord-Gastonia, NC-SC	43,500	17,730

Markets ranked by greatest absolute gain in tech employees in 2016

	Total employed in tech occupations	Greatest 1yr growth
Los Angeles-Long Beach-Anaheim, CA	161,410	14,020
New York-Newark-Jersey City, NY-NJ-PA	289,130	8,230
Atlanta-Sandy Springs-Roswell, GA	114,580	8,000
Chicago-Naperville-Elgin, IL-IN-WI	149,500	7,730
San Francisco-Oakland-Hayward, CA	135,380	7,310
Boston-Cambridge-Nashua, MA-NH	133,660	7,020
Raleigh, NC	34,530	5,120
Seattle-Tacoma-Bellevue, WA	125,650	4,330
San Jose-Sunnyvale-Santa Clara, CA	130,550	4,190
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	95,260	4,100

Markets ranked by strongest job growth in 2016 (includes only markets with 5,000+ tech professionals)

	Total employed in tech occupations	Greatest 1yr % change
Madison, WI	23,750	18.4%
Raleigh, NC	34,530	17.4%
Provo-Orem, UT	9,890	13.8%
Ogden-Clearfield, UT	5,370	13.1%
Fayetteville-Springdale-Rogers, AR-MO	8,120	12.9%
Richmond, VA	22,770	12.7%
Boulder, CO	12,860	12.0%
New Orleans-Metairie, LA	7,550	11.2%
Santa Maria-Santa Barbara, CA	5,040	10.8%
New Haven, CT	5,900	9.9%

Markets ranked by strongest job growth 2011–2016 (includes only markets with 5,000+ tech professionals)

	Total employed in tech occupations	Greatest 5yr % change
Peoria, IL	5,090	157.1%
Charlotte-Concord-Gastonia, NC-SC	43,500	68.8%
Charleston-North Charleston, SC	9,990	64.9%
Madison, WI	23,750	64.2%
Ogden-Clearfield, UT	5,370	51.3%
Raleigh, NC	34,530	50.9%
San Francisco-Oakland-Hayward, CA	135,380	49.5%
Oklahoma City, OK	15,190	49.5%
Phoenix-Mesa-Scottsdale, AZ	76,340	47.9%
Portland-Vancouver-Hillsboro, OR-WA	43,130	46.6%

Markets ranked by greatest average annual tech wage

	Average annual tech wage 2016
San Jose-Sunnyvale-Santa Clara, CA	$123,600
San Francisco-Oakland-Hayward, CA	$112,410
Seattle-Tacoma-Bellevue, WA	$109,720
Washington-Arlington-Alexandria, DC-VA-MD-WV	$104,280
Vineland-Bridgeton, NJ	$103,330
New York-Newark-Jersey City, NY-NJ-PA	$99,300
Boston-Cambridge-Nashua, MA-NH	$98,380
Denver-Aurora-Lakewood, CO	$96,880
Trenton, NJ	$96,550
Baltimore-Columbia-Towson, MD	$95,640

Markets ranked by greatest absolute gain in tech wages in 2016

(includes only markets with 5,000+ tech professionals)

	Average annual tech wage 2016	Greatest 1yr growth
Columbus, OH	$88,700	$8,380
Portsmouth, NH-ME	$93,460	$6,940
Sherman-Denison, TX	$70,430	$6,830
Yuba City, CA	$81,300	$5,510
Winchester, VA-WV	$80,680	$5,390
Danbury, CT	$84,760	$5,030
Atlanta-Sandy Springs-Roswell, GA	$88,510	$4,930
Santa Maria-Santa Barbara, CA	$94,600	$4,730
Bakersfield, CA	$87,720	$4,600
Denver-Aurora-Lakewood, CO	$96,880	$4,480

Markets ranked by greatest absolute gain in tech wages 2011–2016

(includes only markets with 5,000+ tech professionals)

	Average annual tech wage 2016	Greatest 5yr growth
Peoria, IL	$84,270	$20,550
Seattle-Tacoma-Bellevue, WA	$109,720	$19,760
Binghamton, NY	$83,650	$19,390
Portsmouth, NH-ME	$93,460	$16,750
San Francisco-Oakland-Hayward, CA	$112,410	$16,510
Ocean City, NJ	$79,830	$15,900
Santa Maria-Santa Barbara, CA	$94,600	$15,410
Anchorage, AK	$86,160	$15,180
Denver-Aurora-Lakewood, CO	$96,880	$15,150
Columbus, OH	$88,700	$14,300

Markets ranked by strongest wage growth in 2016

(includes only markets with 5,000+ tech professionals)

	Average annual tech wage 2016	Greatest 1yr % change
Sherman-Denison, TX	$70,430	10.7%
Columbus, OH	$88,700	10.4%
Portsmouth, NH-ME	$93,460	8.0%
Yuba City, CA	$81,300	7.3%
Winchester, VA-WV	$80,680	7.2%
Danbury, CT	$84,760	6.3%
Atlanta-Sandy Springs-Roswell, GA	$88,510	5.9%
Bakersfield, CA	$87,720	5.5%
Santa Maria-Santa Barbara, CA	$94,600	5.3%
Vallejo-Fairfield, CA	$90,830	5.0%

Markets ranked by strongest wage growth 2011–2016

(includes only markets with 5,000+ tech professionals)

	Average annual tech wage 2016	Greatest 5yr % change
Peoria, IL	$84,270	32.3%
Binghamton, NY	$83,650	30.2%
Ocean City, NJ	$79,830	24.9%
Seattle-Tacoma-Bellevue, WA	$109,720	22.0%
Portsmouth, NH-ME	$93,460	21.8%
Anchorage, AK	$86,160	21.4%
Santa Maria-Santa Barbara, CA	$94,600	19.5%
Columbus, OH	$88,700	19.2%
Denver-Aurora-Lakewood, CO	$96,880	18.5%
Charlottesville, VA	$85,760	18.4%

Source: JLL Research, BLS Occupational Employment Statistics 2016, Computer and Mathematical Occupations

About JLL

JLL (NYSE: JLL) is a leading professional services firm that specializes in real estate and investment management. A Fortune 500 company, JLL helps real estate owners, occupiers and investors achieve their business ambitions. In 2016, JLL had revenue of $6.8 billion and fee revenue of $5.8 billion and, on behalf of clients, managed 4.4 billion square feet, or 409 million square meters, and completed sales acquisitions and finance transactions of approximately $145 billion. At the end of the third quarter of 2017, JLL had nearly 300 corporate offices, operations in over 80 countries and a global workforce of over 80,000. As of September 30, 2017, LaSalle Investment Management had $59.0 billion of real estate under asset management. JLL is the brand name, and a registered trademark, of Jones Lang LaSalle Incorporated. For further information, visit ir.jll.com.

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