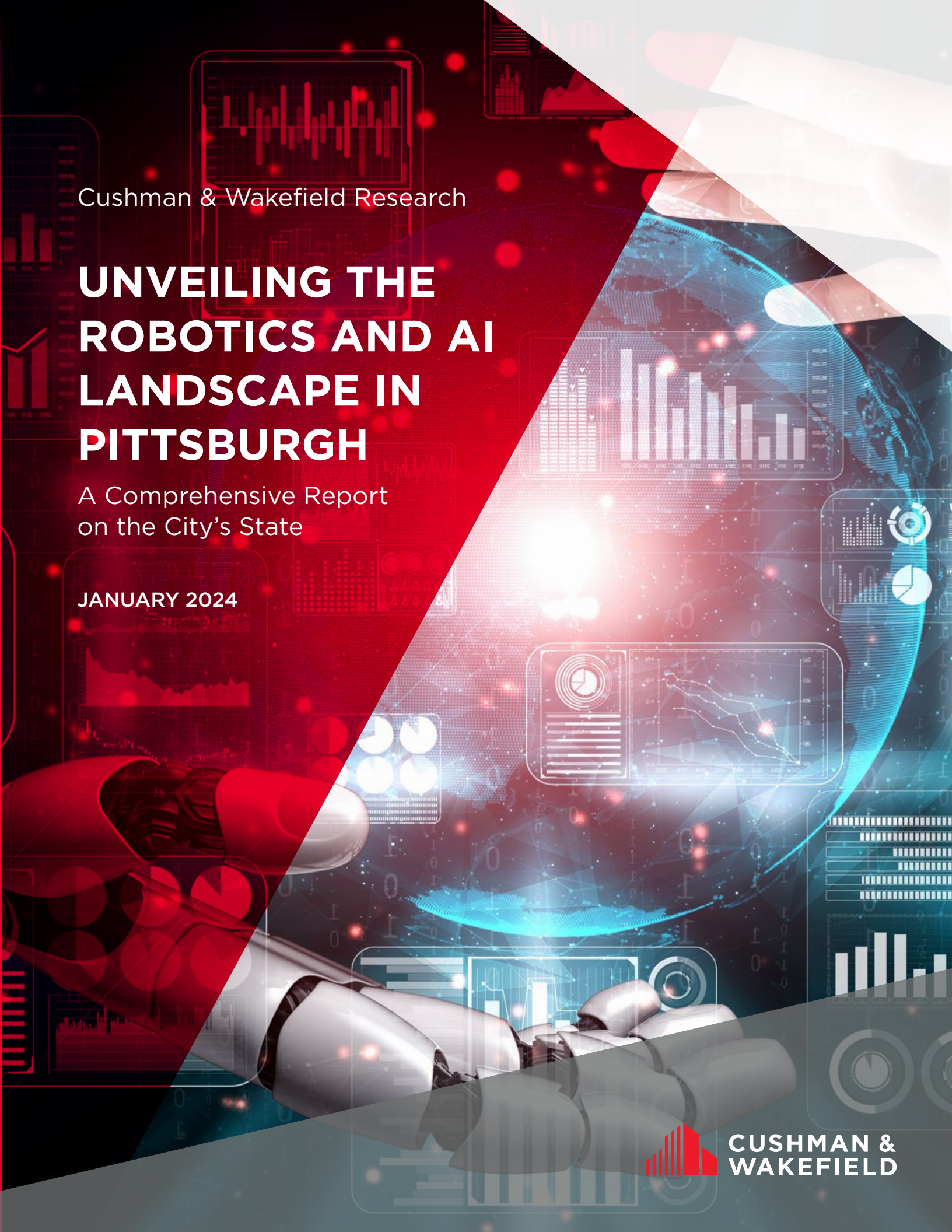




Cushman & Wakefield Research

UNVEILING THE ROBOTICS AND AI LANDSCAPE IN PITTSBURGH

A Comprehensive Report
on the City's State

JANUARY 2024



**CUSHMAN &
WAKEFIELD**

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INTRODUCTION

The city of Pittsburgh has emerged as a dynamic hub for innovation and technological advancement, with a burgeoning ecosystem in the realms of robotics and artificial intelligence (AI). This research report delves into the multifaceted landscape of Pittsburgh's robotics and AI sectors, offering an in-depth exploration of key aspects that shape the city's technological identity.

Pittsburgh, a relatively small and unassuming metro, was historically known for its steel industry and blue-collar economy. Yet, the Steel City has undergone a remarkable transformation into an internationally recognized hotbed of innovation and entrepreneurship. The report considers how the local universities have acted as a catalyst for this transformation. Moreover, this report considers how the commercial real estate inventory has supported, and can continue to support, this transformation.

This report also looks at the current tech companies in the Pittsburgh area. These companies are classified by three criteria: impact on society, industry vertical, and industry horizontal. The flow of external funding to tech companies in the

Pittsburgh area is also considered. The report examines which industry verticals and horizontals are receiving the most funding and how the funding picture in Pittsburgh has shifted over time.

Finally, the report examines the real estate decision making of tech companies. Tech companies consider multiple criteria in their site selection process. This report examines the type of space occupied by each type of company and looks at more granular decisions about building specifics like clear height and number of docks. The report assesses where companies decide to locate, uncovering significant patterns in behavior based on how a company is classified. Finally, the report looks at how funding received directly impacts real estate leasing decisions.

Together, these components provide a comprehensive view of the thriving Pittsburgh robotics and AI landscape, unveiling the city's journey from its industrial past to its technological future. It is a narrative of transformation, innovation, and the pursuit of excellence that underscores Pittsburgh's rightful place in the global technology arena.

KEY TAKEAWAYS

- The region has several startups and notable homegrown tech companies, as well as internationally recognized tech giants like Google, Apple, and Meta, demonstrating proof of concept.
- Local universities, Carnegie Mellon and the University of Pittsburgh, produce top-tier talent that spurs the robotic and AI innovation in the area. As such, startups generally congregate near the universities, leading to a heavy concentration of companies in the Greater Downtown, East End, and Oakland submarkets.
- Robotics companies occupy primarily warehouse and flex space, while AI and other tech companies mostly use traditional office space. Robotics companies also value high clear heights, ample access to loading docks, and increased power capabilities.
- To meet the demand of prominent tech firms, several premier tech buildings been built recently. These tech buildings were designed with robotics companies in mind, with open floor plans for testing, ample power capabilities, and best in class office space. Moreover, plenty of development opportunities exist for future growth.
- Pittsburgh-based robotics and AI firms have received international funding attention. Venture Capital (VC) funding has steadily increased each year since 2010. The lion's share of this funding goes toward robotics companies, followed by AI. Medical technology companies received a boost in funding from 2020 to 2022, coinciding with the pandemic.
- There is a positive correlation between funding received and space leased, employees hired, and building class chosen. This suggests that external funding's impact extends beyond just R&D expansion.



WHY PITTSBURGH

In recent years, Pittsburgh has earned nick names like 'Robotics Row' and 'The Robotics Capital of the World' due to the wealth of robotics and AI companies establishing the city as a base of operations. The region has several notable homegrown technology companies such as Duolingo, Astrobot Technology, and Gecko Robotics. In addition, the region has drawn the attention of international tech giants, like Google, Apple, and Meta, demonstrating proof of concept. Such a concentration of tech firms in a relatively unassuming metro leads to one burning question: Why Pittsburgh?

Talent Pool and Education

Pittsburgh is home to several universities spearheading AI and robotics research. The combined academic, research, and development presence of Carnegie Mellon University (CMU) and the University of Pittsburgh (Pitt) leads the way for breakthroughs in AI and robotics, while producing a pipeline of specialized talent, making Pittsburgh an internationally recognized powerhouse in all things tech. Conventional talking points assert that young talent in the universities in time gives way to young talent in the work force, thereby attracting tech companies to the region. Though the principle appears sound, the reality is not so straight forward. Pittsburgh has one of the worst retention rates of college graduates in the country, keeping only half of all recent graduates.¹ This presents a puzzling problem: with such a significant percentage of the young talent leaving, why are technology firms interested in the Pittsburgh region?

CMU's impact on the technology sector cannot be overstated. As a world class institution, CMU attracts some of the best and brightest minds, especially in sphere of robotics and AI. It is true that about half (if not more) of all graduates relocate to other markets.² However, CMU is incredibly proactive in post-graduate research. That is, CMU offers incubation space and mentorship programs for entrepreneurial graduates. These programs offer startups cheap space and frequent consultation with industry veterans. This guidance proves invaluable for the inexperienced startups on

their journey from research to commercialization. It affords entrepreneurial opportunity to graduates who otherwise would not have it. According to Cushman & Wakefield research, with 57.9% of all robotics and AI firms in Pittsburgh having some connection to CMU, it becomes evident just how important the university is to the tech sector, even if much of the graduating talent leaves the Pittsburgh area. While many graduates may leave the region, those who stay are likely on the edge of innovation. This phenomenon gives Pittsburgh a unique and highly skilled tech labor force. The city is not oversaturated with young talent but has enough entrepreneurial startups to produce an air of excitement.

This avenue for startups is a spark plug for the entire Pittsburgh technology sector. On one hand, successful startups can eventually mature into fully fledged corporations pushing the frontier of research. Though many startups do not make the leap to perennial tech giant, the abundance of such startups still merits attention. A region crawling with startups piques the interest of already fully matured tech companies. Proximity to these startups affords fully developed companies the opportunity to recruit premier talent, or even acquire the entire company and its coveted intellectual property (IP). The end stage for many of these startups is being acquired. Whether the startup eventually becomes the next big tech corporation, or it simply makes enough noise to attract the already existing big tech companies to the area, these startup companies are the catalysts that drive the tech sector in Pittsburgh.

The idea that tech giants flock to the Pittsburgh region because of the young talent and startups is evidenced by where these firms establish operations. Consider Apple, Google, and Meta. All three firms have established offices in Oakland or the East End, which are within striking distance of university campuses. In some cases, the tech companies even have locations within campus boundaries. Close proximity to the campus enables these tech giants to forge connections with the young talent still in school and the exciting startups who still have close ties with the universities. Essentially, the gravity of CMU (in particular) and Pitt draws top-tier tenants to the region.

¹ Source: Allegheny County Conference

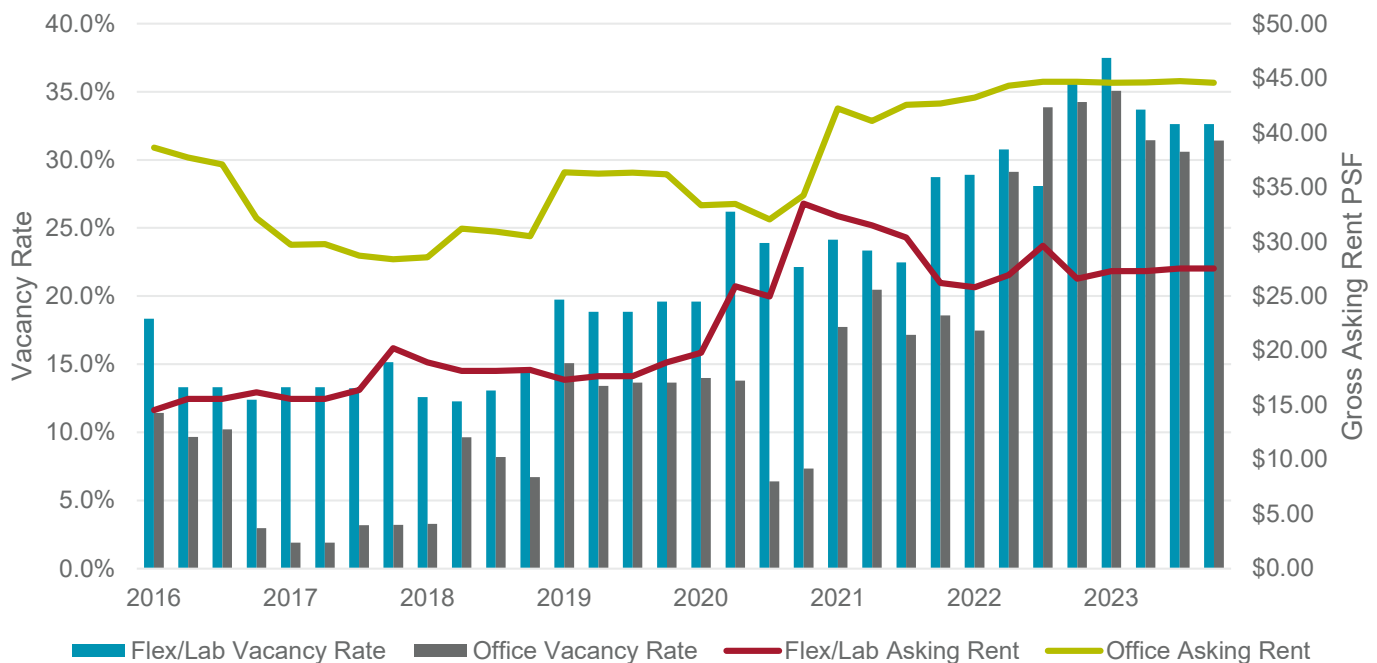
² See Appendix for justification

Existing Real Estate

A thriving and tight-knit tech community only exists and expands if there is real estate to support it. That is, an innovation district requires innovation, and innovation requires a physical space to practice said innovation. Therefore, real estate is an integral piece of the equation for the success of an innovation district. The real estate market needs to be able to service all facets of the innovation district. There needs to be best-in-class space for the top-tier tenants, industrial space for manufacturing leaning companies, and traditional office space. Finally, there needs to be plenty of opportunity for future expansion and the capability for built-to-suit (BTS) projects to meet incoming demand. The Pittsburgh region meets these needs.

Pittsburgh has over 5.0 million square feet (msf) of space geared toward housing upper echelon tech companies. Of this 5.0 msf, 2.2 msf is explicitly designed for research and development (R&D) operations, with the remainder acting as office support space (though these office spaces often have the capacity to be built out as R&D spaces). The office buildings considered are a subset of all the traditional office space in Pittsburgh. The buildings were handpicked as office space that meets the desires of top-tier tech companies. This selection methodology was derived from past leasing activity and broker experience working with top tech companies. Figure 1 details the vacancy rates and rental rates in these buildings over time.

Figure 1: Tech Space Asking Rate v. Vacancy Rate



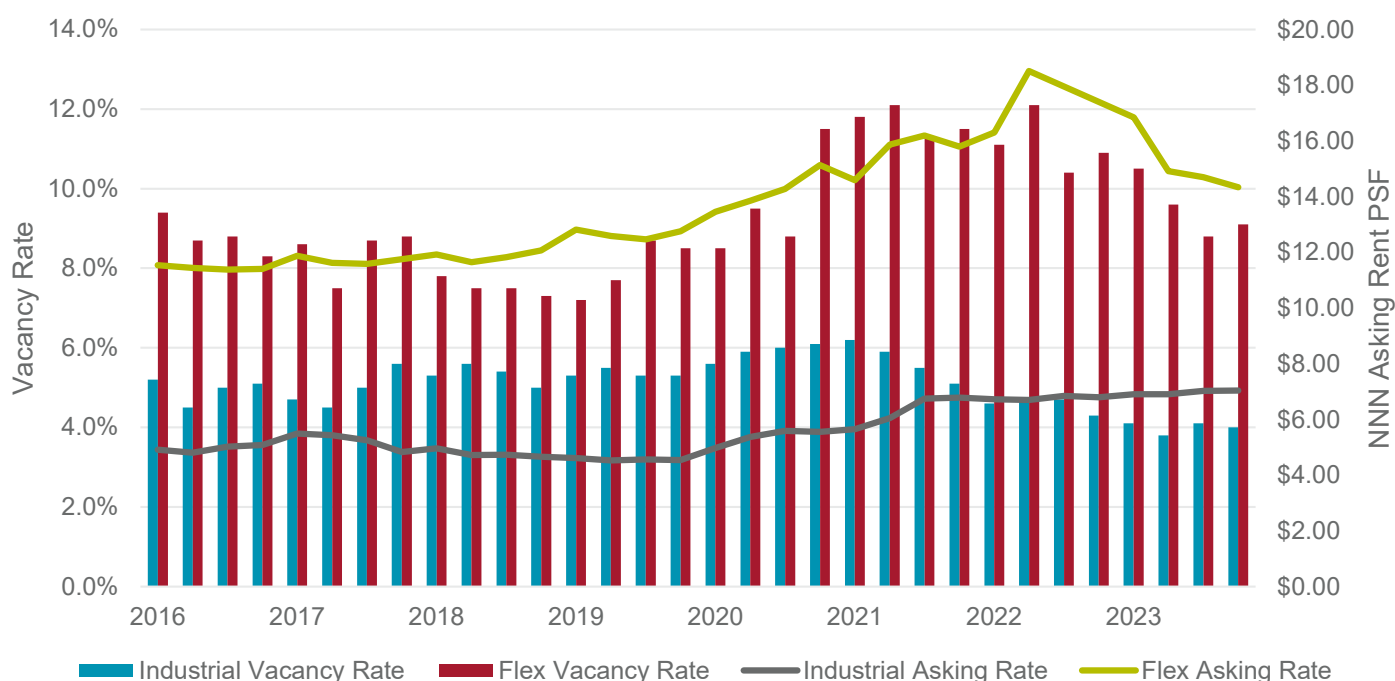
Source: Cushman & Wakefield Research, CoStar

Currently, competitive office space for these top-tier tech buildings has an asking rate just under \$45.00 gross per square foot (psf). The asking rate increased over time (likely due to recent deliveries of premier space), plateauing as of late. Flex/lab space is less expensive on a psf-basis, currently at \$27.50 gross psf. Similar to the tech office space, asking rates are elevated over time, plateauing as of late. The vacancy rate for office space is 31.4%, dramatically increasing over the past two years. This dramatic rise is mostly due to recent deliveries. Flex/lab space has a vacancy rate of 32.6%, steadily increasing over time, though slightly down since Q4 2022. The steady increase of the flex/lab vacancy rate is due, in part, to renovations and deliveries, but is also because of a general decrease in demand for this type of space due to post-pandemic market conditions.

High vacancy rates in both asset classes imply a tenant favorable market, meaning prospective tenants possess most of the negotiating power. Increased negotiating power enables tenants to procure more generous tenant improvement packages (TI), leading to completer and more sophisticated R&D space build outs. Moreover, it means there is plenty of space for large prospective tenants to move into the Pittsburgh region. As such, Pittsburgh is ripe with opportunities for established tech companies looking to relocate or expand.

However, not all tech companies are looking for top-tier space. The technology sector is full of new startups and mid-sized companies looking for affordable space capable of handling industry requirements. These firms may opt for low-end flex and industrial space as a sort of pseudo flex/lab space. This low-end flex or industrial space provides companies with open floor plans and high ceilings capable of accommodating day-to-day industry requirements. Figure 2 is a time series detailing flex and industrial average asking rental rates versus average vacancy rates.

Figure 2: Industrial and Flex Asking Rates v. Vacancy Rates

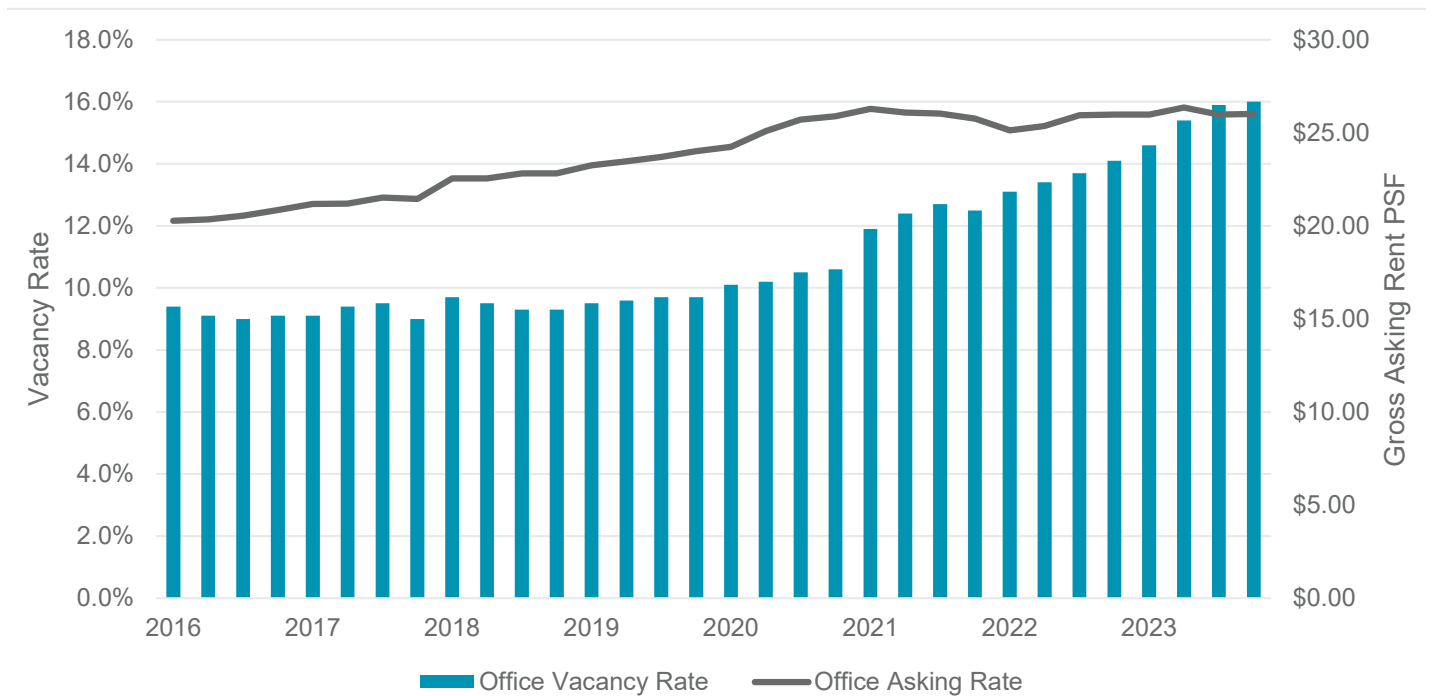


Source: Cushman & Wakefield Research, CoStar

Significantly cheaper than top-tier tech space, these asset classes afford startups and mid-sized tech companies the space to operate on a budget. The market is significantly tighter than top-tier tech space, but there is a much larger inventory to choose from (16.8 msf and 145 msf).

Tech companies also need purely traditional office space. Pittsburgh offers a wealth of office space in a variety of different submarkets. Figure 3 is a time series of average asking rental rates versus average vacancy rates for traditional office space.

Figure 3: Office Asking Rate v. Vacancy Rate



Source: Cushman & Wakefield Research, CoStar

On top of the existing real estate inventory, the Pittsburgh region offers multiple avenues for redevelopment. Peppered throughout the city are former steel mills, many of which are nothing more than artifacts of a past age. These structures, which are currently deemed functionally obsolete, offer tremendous upside for robotics re-development. With the infrastructure already in place, minor alterations can be made to outfit these buildings as premier technology centers. These structures often sprawl beyond 200,000 sf, making them large enough to house even the largest tenant requirements. Moreover, with clear heights in excess of 30 feet, floors built to handle massive machinery, and power capable of running major mills 24/7, these buildings meet all the industry specific requirements of even the most advanced robotics firms. Having these structures in place affords Pittsburgh a competitive advantage in constructing top of the line technology centers capable of garnering attention from even the most advanced firms on the global stage.

So, Why Pittsburgh?

All in all, tech firms will generally congregate around the talent, as human capital is what drives innovation. Pittsburgh's premier universities bring said talent to the area. Although a large portion of this talent leaves upon graduation, the universities still foster an environment of innovation. CMU and the PITT offer enough incentives, via mentorship programs, financial support, and goodwill by association, to keep specialized entrepreneurial minds in the area. Moreover, Pittsburgh has the inventory to not only meet current real estate needs, but also to offer an avenue for rapid and major expansion for the tech industry.

COMPANIES IN PITTSBURGH

Many different companies can be considered tech related. These companies vary drastically in the impact made, product produced, and technology leveraged. As such, a macrolevel view of the data does not yield many meaningful insights. Therefore, each company is classified according to their impact made, product produced, and technology leveraged.

Impact Classification Method

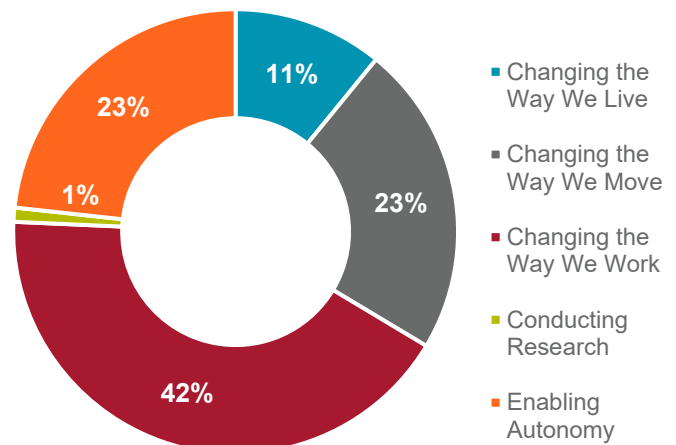
The first classification method considers the impact of the service or product produced.³ This method seeks to classify **how** a tech company is driving innovation. Below are definitions of the relevant classification groups for the *impact* method.

- **Changing the way we live:** Companies that provide services or products that directly impact day-to-day life experiences of the general populous. These products and services are **final** goods (as the consumer is the general populous) spanning many industries.
- **Changing the way we move:** Companies that produce innovative transportation related technology. This technology can range from self-driving cars to AI programs designed to solve traffic problems. These products and services range from **final** goods to **intermediate** goods, as some of the technology is also intended to be used by other companies.
- **Changing the way we work:** Companies that create technology to streamline workplace processes. These products and services are **intermediate** goods, as they are intended to be used in the workplace by other companies as opposed to the general populous. These products and services can range from automated warehouse machinery to AI programs tracking workplace productivity.
- **Conducting research:** Companies that are exclusively conducting theoretical research. These companies focus on developing new ways to understand robotics and AI as a discipline.

- **Enabling autonomy:** These companies seek to use AI to expedite repetitive tasks. The products and services range from data aggregation models to robotics engineering services. These are both **final** and **intermediate** goods.

Every tech company within the Pittsburgh Metropolitan Statistical Area (MSA) was assigned to a group according to the *impact* aggregation method. Figure 4 is the breakout of tech companies according to this method.

Figure 4: Company Composition by Impact Method

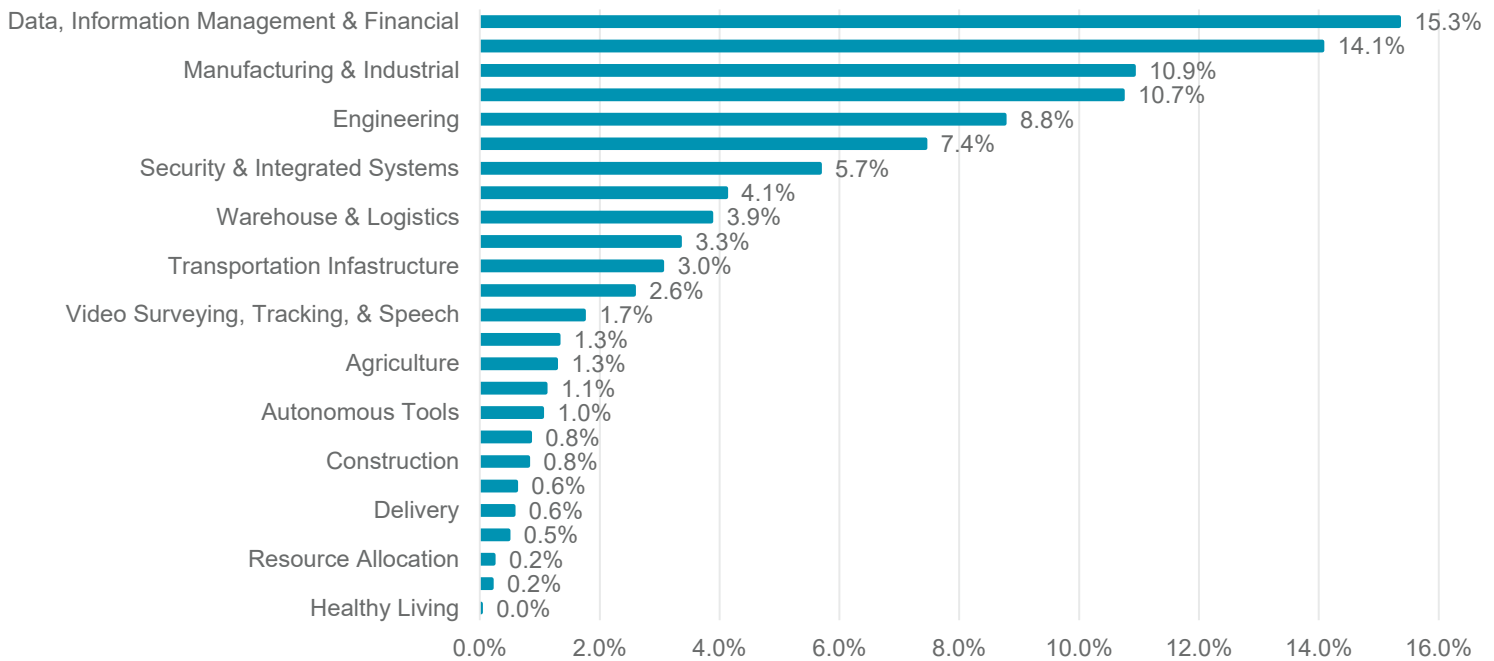


Source: Cushman & Wakefield Research

Of all the space occupied by tech companies in Pittsburgh, just over 42% is occupied by companies that are *changing the way we work*. Companies *enabling autonomy* and *changing the way we move* occupy 23.3% and 22.7% of all tech space in Pittsburgh, respectively. Companies *changing the way we live* account for 10.9% of the tech space occupied, while pure research (*conducting research*) accounts for less than 1.0% of the market. This relationship is more or less the same when just counting the institutions in each group (i.e., not factoring in the square foot presence of each firm). The above breakout is in line with preconceived expectations. Companies improving workplace efficiencies dominate the market, matching the cultural importance placed production in America. Moreover, the prevalence of *changing the way we move* companies fits the narrative of Pittsburgh being a hub for autonomous vehicles.

³ This method of classification was adopted (and tweaked) from the Pittsburgh Robotics Network.

Figure 5: Company Composition by Industry Vertical Method



Source: Cushman & Wakefield Research

Industry Vertical Classification Method

Another method for classifying tech companies looks at the sector. This aggregation method is termed the *industry vertical* classification method. While the impact method seeks to explain **how** innovation is occurring, the *industry vertical* method explains **where** innovation is taking place. Below is a list of all industry verticals used in this analysis.⁴

- Aerospace & Defense
- Agriculture
- Autonomous Tools
- Components
- Conducting Research
- Construction
- Consumer Products
- Data, Information Management & Financial
- Delivery
- Education
- Engineering
- Healthcare
- Healthy Living
- Inspection & Maintenance
- Manufacturing & Industrial
- Marketing
- Mining
- Planes, Trains, Trucks & Automobiles
- Resource Allocation
- Retail
- Safety
- Security & Integrated Systems
- Transportation Infrastructure
- Video Surveying, Tracking & Speech
- Warehouse & Logistics

Every tech company within the Pittsburgh MSA was assigned to a group according to the *Industry Vertical* aggregation method. Figure 5 is the breakout of tech companies according to said method.

The *data, information management & financial* vertical accounts for 15.3% of the space occupied in Pittsburgh. Also of note, *planes, trains, trucks & automobiles* account for 14.1% of the space occupied in the region. The *manufacturing & industrial* and *healthcare* verticals account for 10.9% and 10.7% of the space occupied, respectively. The remainder of the verticals, barring *engineering*, *consumer products*, and *security & integrated systems*, account for less than 5.0% of the market. Just as in the impact aggregation method, the leading groups align with expectation. For example, improving data analytics techniques and financial analysis are center stage in the discussion for AI innovation. As such, it only makes sense that such a heavy concentration of companies in Pittsburgh. Moreover, the prevalence of *planes, trains, trucks & automobiles* again matches the sentiment that Pittsburgh is a landing place for autonomous vehicle research. Pittsburgh is also known for *healthcare*, with the likes of UPMC and Highmark having major presences. As such, it is natural that the healthcare vertical is relatively prominent within the Pittsburgh tech sector.

⁴ An explanation of each industry vertical is not provided as most are self-explanatory. For more information on what constitutes each industry vertical, contact steven.patterson@cushwake.com.

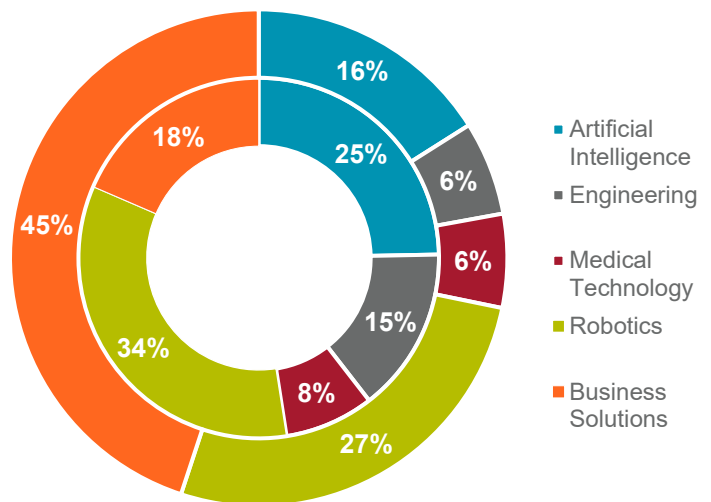
Industry Horizontal Classification Method

The final way to segment the data is the *industry horizontal* aggregation method. This method attempts to answer **what** the tech companies are producing. The categories speak directly to the type of technology used in typical day-to-day operations. Below are the classifications.

- **Robotics:** Companies that utilize physical robotics machinery in day-to-day operations. The method of use can vary so long as physical equipment is used. Exceptions include companies that use robotics for medical purposes (see medical technology definition).
- **Artificial Intelligence:** Companies that utilize AI or software platforms AND do not use robotics machinery. The method of use can vary so long as AI is the primary technology used.
- **Medical Technology:** Companies whose day-to-day operations require medical expertise. These companies may leverage AI and/or robotics but have a primary application of healthcare. These companies are classified as medical horizontal (and not robotics/AI) because of the added level of medical expertise needed.
- **Business Solutions:** General tech companies focusing on commercializing technology. Most workers at these companies are in the business sphere, focusing on marketing, sales, and operations for well-established tech companies. These companies are generally large multinational corporations like Apple or Microsoft. These companies may use other industry horizontals (like robotics or AI) but are heavily focused on business operations.
- **Engineering:** Companies focusing on engineering consulting and services

Every tech company within the Pittsburgh MSA was assigned to a group according to the *industry horizontal* aggregation method. Figure 6 is the breakout of tech companies according to this method.

Figure 6: Company Composition by Industry Horizontal Method



Source: Cushman & Wakefield Research

The above graph compares the number of companies in Pittsburgh (inner circle) with the amount of space occupied by each horizontal (outer circle). Business solutions firms have a disproportionate share of the space occupied in the market, accounting for 45% of the space despite only being 18% of the companies. The most prominent horizontal is robotics, accounting for 34% of the companies, but falling to only 27% of the space occupied. AI and engineering firms account for 25% and 15% of the firms in the tech sector, but when considering space occupied, drop to 16% and 6%, respectively. The percentage of medical technology companies and the space occupied by them is comparable, standing at 8% and 6%, respectively.

The disproportionately high amount of space occupied by business solutions firms is likely attributable to the average maturity of each industry horizontal. Business solutions are generally more mature, often deep in revenue generating and profitability stages of the business life cycle. As such, these firms tend to have a larger footprint, although only a portion may be dedicated to tech centered operations. Conversely, robotics and AI firms are typically startups (at least in the Pittsburgh market). Given their youth, these firms do not have large space requirements. As such, the amount of space occupied by these horizontals is more of a commentary on the business development stage rather than the amount of space needed to conduct business.

⁵ Average age of companies by Industry Horizontal, Industry Vertical, and Industry Impact are provided in the Appendix.

FUNDING

Funding Definitions

The majority of robotics and AI companies in the Pittsburgh area stem from CMU startups, making many of the tech firms in Pittsburgh pre-commercialized entities. In other words, these companies are not yet generating revenue; their daily operations exclusively revolve around research and development. However, they still have to manage expenses and overhead costs, such as employee salaries and materials, even in the absence of revenue. This financial challenge is particularly pronounced in the early stages of development. External funding plays a vital role in addressing these challenges. Furthermore, more established companies also rely on external funding to finance substantial costly projects, a common occurrence in the technology sector. As a result, the flow of funding within a market is paramount to the success of tech companies.

There are many avenues for companies to receive funding, ranging from accelerator programs to equity crowdfunding. Below are the categories considered in this analysis.

- VC Funding: Cash investments made in companies with substantial growth potential.
- Grants: Monetary endowments given to a company based on the company qualifying for some assistance program.
- Accelerator: Monetary value received through some sort of mentorship program. For the purposes of this analysis, all mentorship programs stem from CMU or Pitt.
- Equity Crowdfunding: Public or private trading of stock.
- Seed Round: Funding at the start of company.

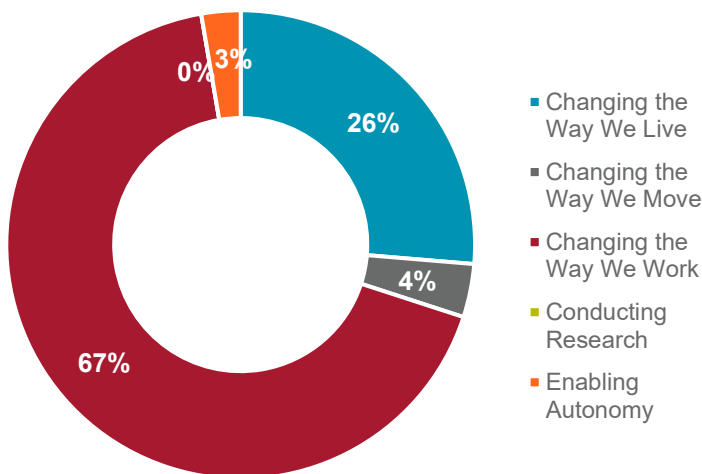
For this analysis, the results are broken into two groups: Total Funding and VC Funding. Total Funding includes all forms of funding received. VC funding accounts for only VC investments. Total Funding gives a complete picture of the investments occurring in Pittsburgh. However, there are a few outlying equity crowdfunding transactions that dominate the aggregation. This could lead to misleading inferences on typical motivations behind investments. On the other

hand, VC funding gives a clearer picture of the motivations behind investment.

Funding by Impact Classification Method

Consider the venture capital funding received by companies based on the impact classification method since 2010. Figure 7 illustrates this relationship.

Figure 7: Venture Capital Funding by Impact



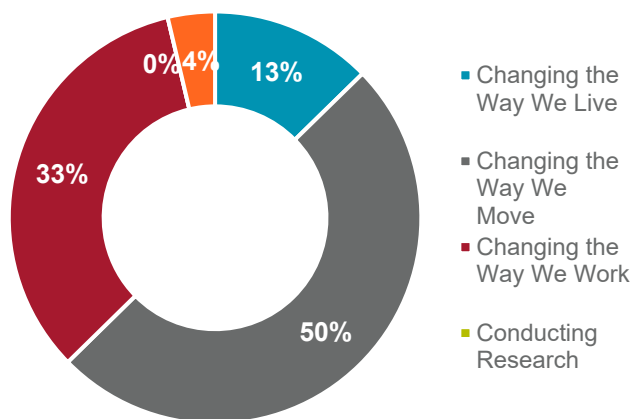
Source: Cushman & Wakefield Research, PitchBook

Companies that are *changing the way we work* account for two-thirds of all VC funding in the Pittsburgh region. Companies *changing the way we live* account for 26.0% of the VC funding received. *Changing the way we move* and *enabling autonomy* companies round out the remainder of VC funding. Recall that 42.0% of the presence of tech companies is changing the way we work. As such, there is a disproportionately high amount of VC funding going to companies that are *changing the way we work*. This suggests investors are taking particular interest in companies spurring workplace innovation. Likewise, companies *changing the way we live* account for 10.9% of the presence but make up 26.0% of the VC funding. Again, companies are taking particular interest in companies *changing the way we live*. Companies *enabling autonomy* and *changing the way we move* make up a disproportionately low amount of total VC funding received. At first glance this is puzzling, given all the buzz surrounding Pittsburgh based autonomous driving centers. There are two explanations for this result.

First, the analysis only includes companies that currently have a location in Pittsburgh. As such, the funding received by prominent autonomous vehicle companies that exited the Pittsburgh market like Argo AI, Locomotion, and Uber is omitted from the analysis.

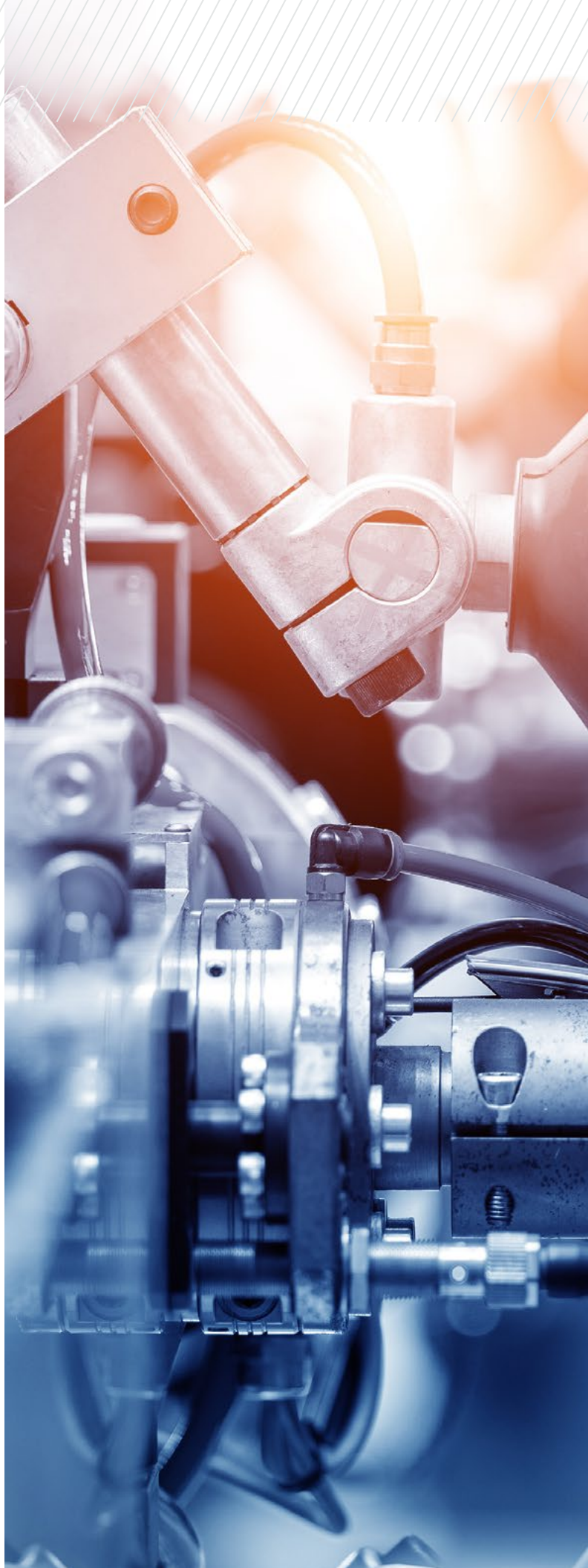
Secondly, Figure 7 only plots VC funding. When considering all funding types, the picture changes drastically. Figure 8 details the breakout with all funding types.

Figure 8: Total Funding by Impact



Source: Cushman & Wakefield Research, PitchBook

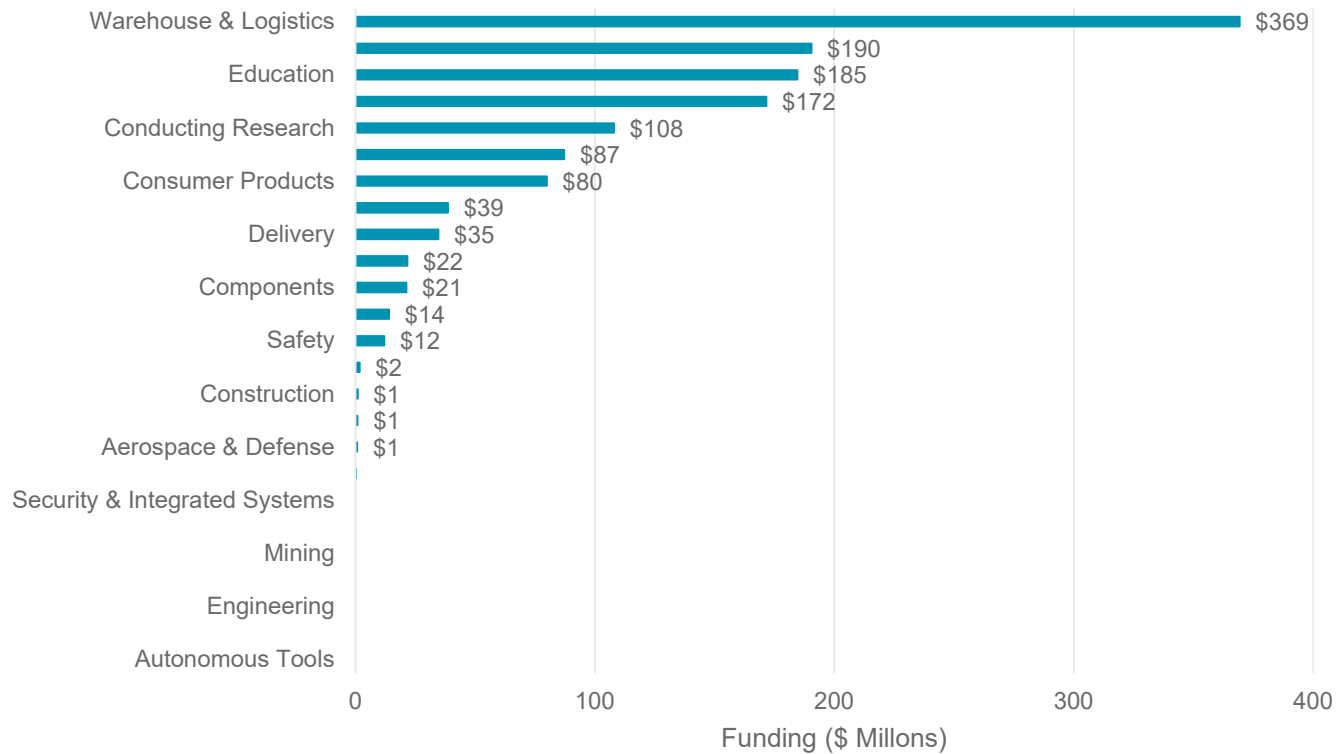
With all forms of funding considered, half of all money goes to companies *changing the way we move* (i.e., autonomous vehicles). This complete reversal of the relationship is due almost entirely to Aurora receiving \$853 M in 2023 and \$530 M in 2019 via a combination of public and private offerings. Such an outlier of funding is certainly important to note but obscures the typical free flow of funding in the region. As such, a distinction between VC funding and total funding is necessary.



Funding by Industry Vertical Classification Method

Next, where the funding goes based on industry vertical is examined. This method comments on what industries investors view as the most promising. Figure 9 details VC fundings across industry verticals.

Figure 9: Venture Capital Funding Since 2010 by Industry Vertical



Source: Cushman & Wakefield Research, PitchBook

*Note: No VC funding for healthy living, security etc in 2023.

By far and away, *warehouse & logistic* companies received the largest share of the VC funding. The *education* and *healthcare* verticals received the second and third most funding at 14.0% of the market share each. *Inspection & maintenance* companies also received a sizeable share of the VC funds at 13.0% of the total market. The remainder of the verticals received relatively small shares.

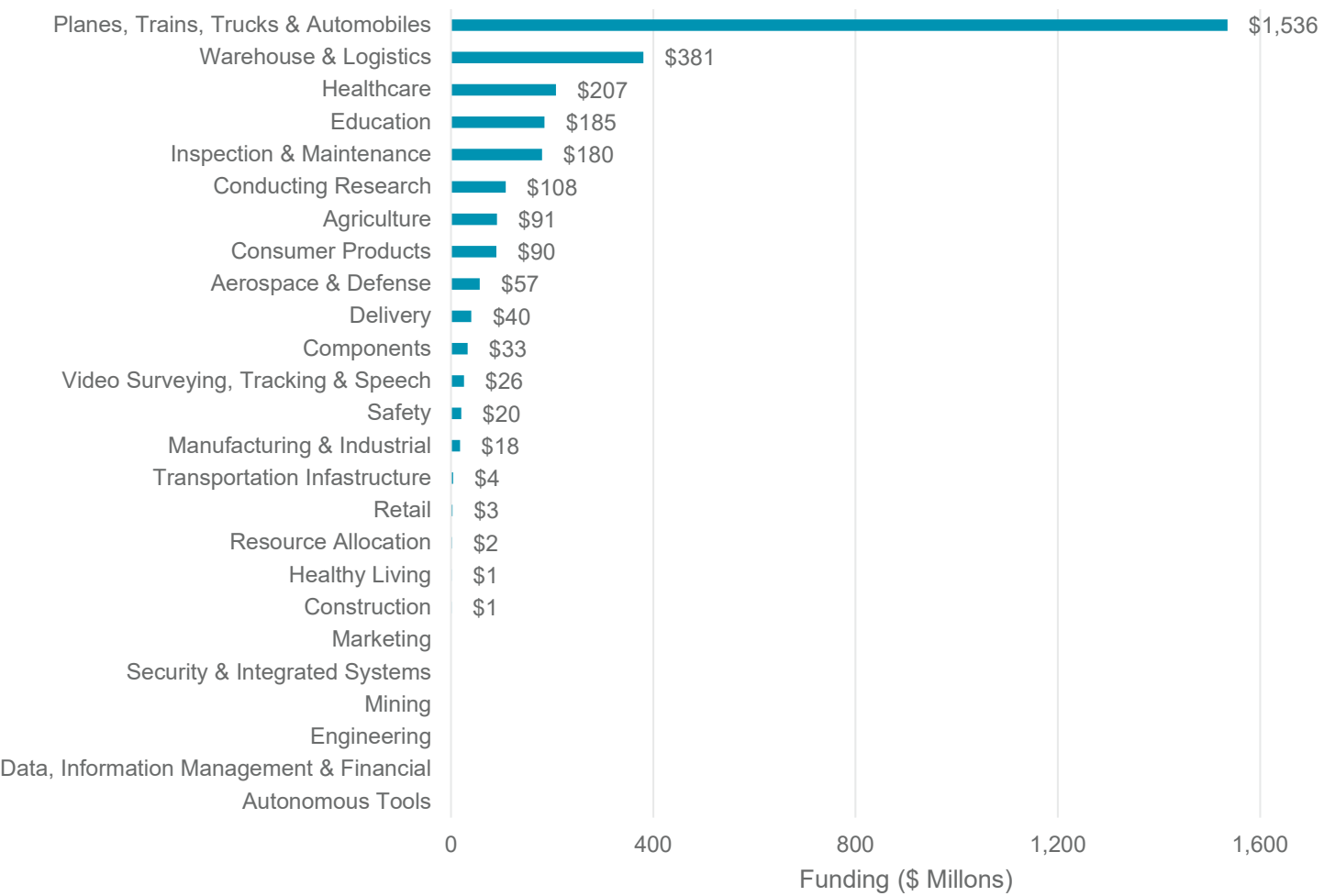
Over 41.0% of the total funding went to *warehouse & logistic* and *inspection & maintenance* companies, vastly outperforming their combined market presence of 8.0%. Why are investors so interested in these industry verticals? In short, the potential upside of the technology in these verticals could save millions of dollars in operating costs. Moreover, the path to this technology does not extend years down the road.

Warehouse & logistic technology seeks to build robots capable of automating, sorting, gathering, and shipping tasks for logistics companies. The automation of these processes would lead to a significant reduction in labor costs, ultimately enhancing profitability. Therefore, the prevalence of funding in this industry is likely due to the substantial and achievable benefits offered by this technology.

The *inspection & maintenance* vertical is creating robots capable of scaling tremendous heights and fitting into tight crevasses to inspect infrastructure. These robots provide a complete diagnostic of the integrity of the structure in question, even completing minor repairs in some instances. This technology would revolutionize the world of construction as well as greatly increase the safety of workers.

These industry verticals are just two examples of how exciting, new, creative technology can capture the attention of investors. Next, the total funding received by industry vertical is reviewed. Recall that this method includes public and private stock offerings. Given Aurora’s comparatively massive funding rounds via public and private stock offerings, the results are heavily skewed toward the *planes, trains, trucks & automobiles* vertical. Figure 10 illustrates this result.

Figure 10: Total Funding Since 2010 by Industry Vertical

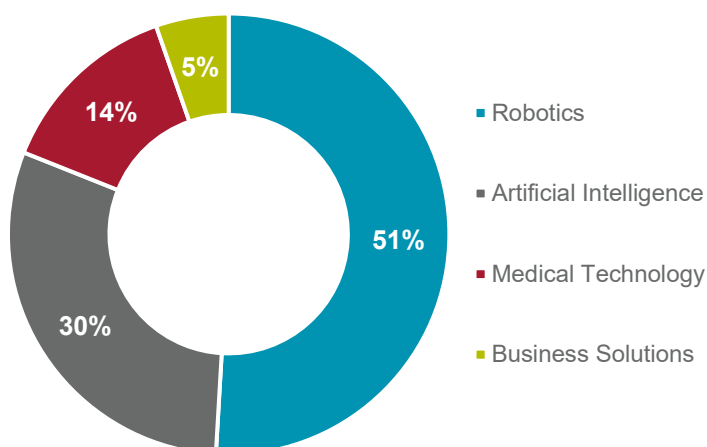


Source: Cushman & Wakefield Research, PitchBook
*Note: No VC funding for marketing, security & integrated systems, etc in 2023.

Funding by Industry Horizontal

Next, which horizontals are receiving the funding is considered. This approach comments on which types of technology investors think are the most promising. Figure 11 is the graph.

Figure 11: Venture Capital Funding by Industry Horizontal



Source: Cushman & Wakefield Research, PitchBook

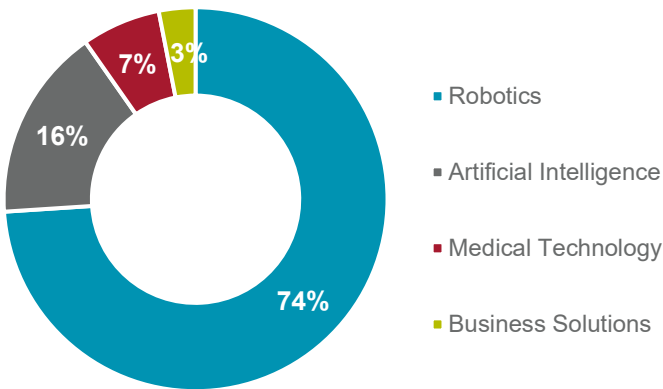
Of all VC funding received, 51.0% is going to companies in the *robotics* industry horizontal. This clearly suggests that investors are most excited about the upside of *robotics* related innovation. This is particularly evident when considering *robotics* companies only account for 34.0% of the companies in the market. Therefore, the VC funding received by *robotics* companies is outperforming the horizontal's presence in the market.

AI companies capture 30.0% of the total VC funding, signifying that there is interest in innovation in that horizontal as well. *AI* firms account for 25.0% of the firms in the market, signifying a slightly more modest outperforming of VC funding share compared to market share.

Medical technology companies also have a greater VC funding share, 14.0%, than the market presence of 8.0%.

When considering total funding, *robotics* companies dominate even more. Figure 12 is the graph.

Figure 12: Total Funding by Industry Horizontal

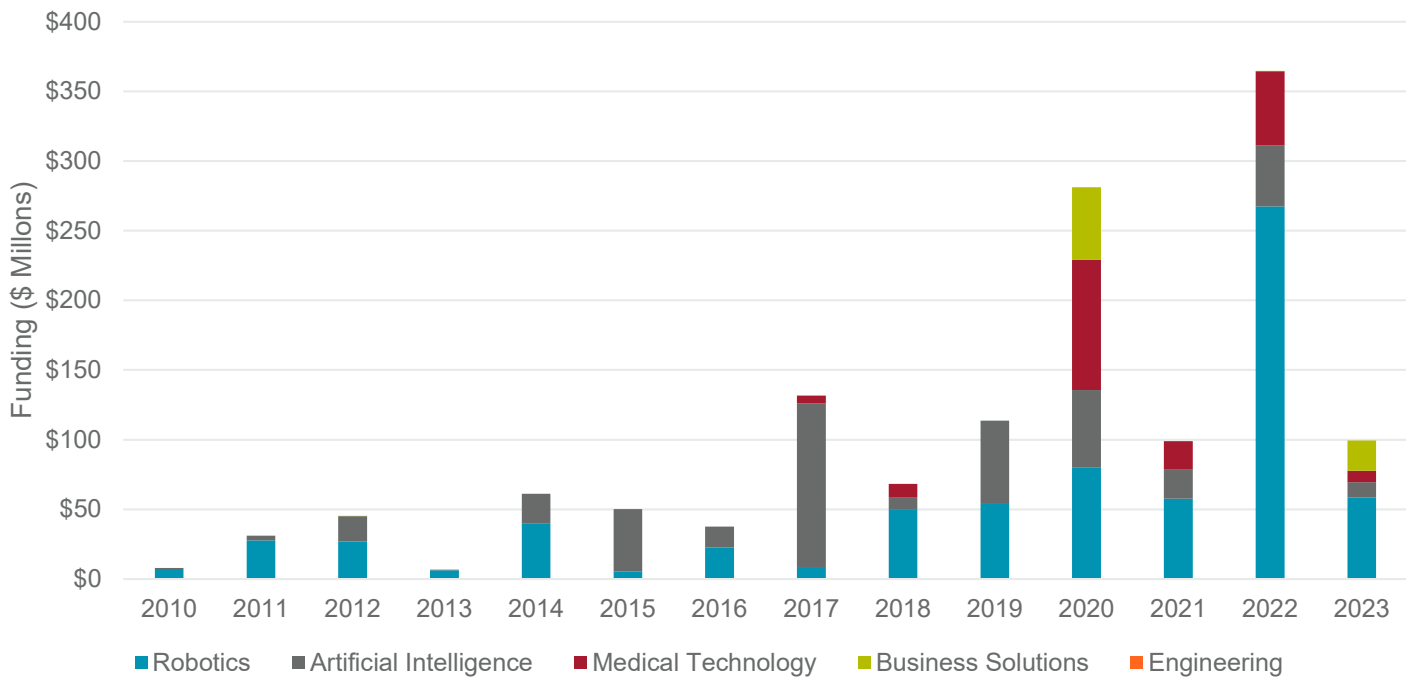


Source: Cushman & Wakefield Research, PitchBook

Funding Across Time

Next, VC funding across time based on the industry *horizontal* aggregation method is examined. The industry *horizontal* method is preferred because it offers meaningful insight. Figure 13 illustrates this relationship.

Figure 13: Venture Capital Funding Across Time

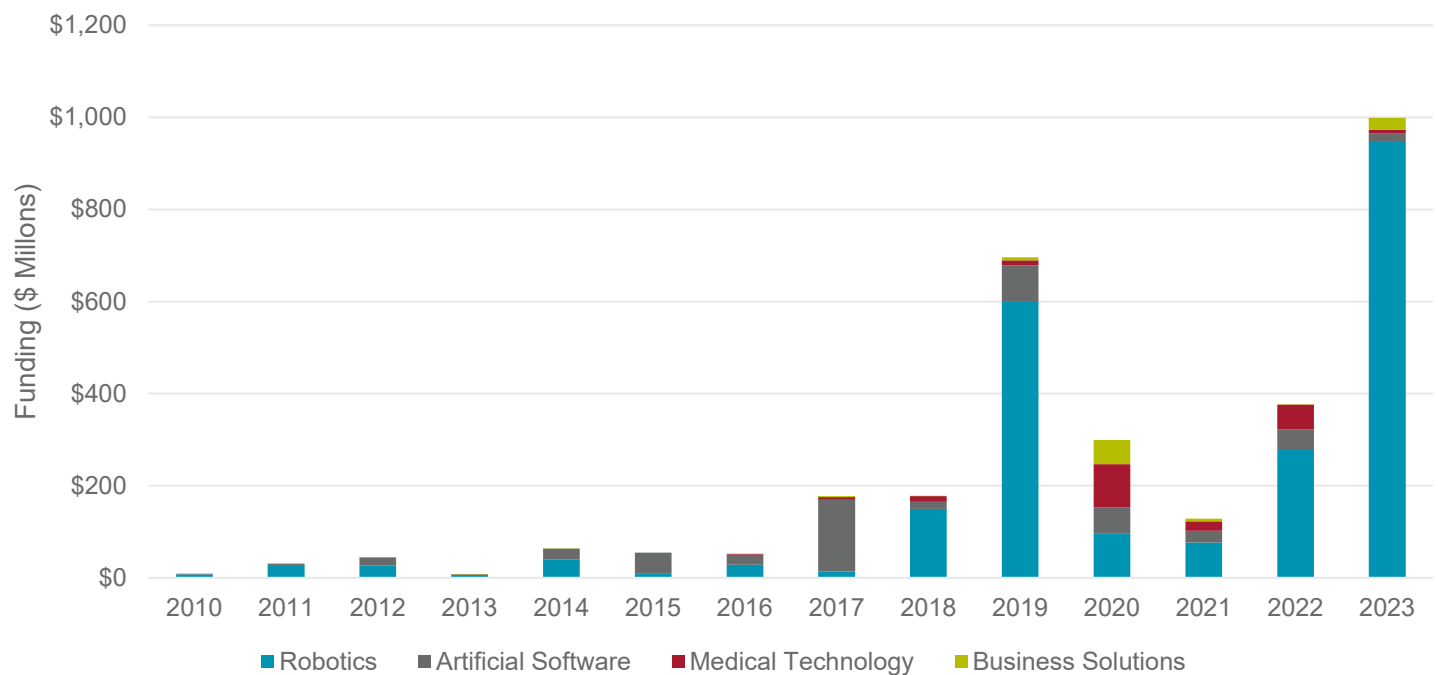


Source: Cushman & Wakefield Research, PitchBook

As evident from Figure 13, VC funding for tech companies has exhibited a general upward trajectory since 2010. Presently, *robotics* companies dominate the funding landscape, marking a noticeable shift away from AI funding. Over the past five years, the typical range for VC funding has fallen between \$100 M and \$150 M. However, 2020 and 2022 notably exceeded this threshold, securing \$281 M and \$364 M, respectively. It's important to note that these years surpassed the \$150 M threshold due to exceptional circumstances. In 2020, \$145 M of the funding was allocated specifically to *medical technology* companies or those closely related to the medical field. This increase in funding can be attributed to the global demand for heightened medical research and development sparked by the onset of COVID-19, a trend that aligns with Pittsburgh's reputation for healthcare-related research. While the surge in *medical technology* funding has continued to a lesser extent since 2020, 2022 recorded \$223 M of VC funding funneled into two robotics companies. These outliers likely reflect investor enthusiasm about specific companies rather than serving as a universal rule for the broader market.

Figure 14 examines total funding in Pittsburgh across time. When considering total funding, *robotics* companies receive an even larger share of the funding. This is due to a handful of prominent companies working on autonomous vehicles, a very exciting and potentially lucrative industry. Recall Aurora received \$853 M in 2023 and \$540 M in 2019.

Figure 14: Total Funding Across Time



Source: Cushman & Wakefield Research, PitchBook



Snapshot of Current Funding Across Time

The table below details the funding activity in the Pittsburgh region during the first three quarters of 2023. From a total funding perspective, 2023 has posted the strongest numbers to date. However, as seen below, the majority of this activity comes from one company. The rest of the funding activity for 2023 is far more modest.

Table 1: Snapshot of Funding 2023

Company	Funding (\$)	Industry Horizontal	Funding Type	Date
StockSnips	5,000,000	Business Solutions	Venture Capital	9/7/2023
PredxBio	601,000	Medical Technology	Venture Capital	8/17/2023
Finish Robotics	889,000	Robotics	Venture Capital	8/16/2023
Astrobotic Technology	34,600,000	Robotics	Grant	7/25/2023
Aspinity	10,700,000	Artificial Intelligence	Venture Capital	7/25/2023
Koop	3,200,000	Business Solutions	Seed Round	7/11/2023
Realyze Intelligence	1,250,000	Medical Technology	Venture Capital	7/11/2023
Aurora	853,000,000	Robotics	General Equity	7/1/2023
BITO	3,200,000	Robotics	Venture Capital	6/13/2023
BlastPoint	5,260,000	Artificial Intelligence	Seed Round	5/31/2023
Abridge	6,400,000	Medical Technology	Venture Capital	5/18/2023
Thoro.ai	7,000,000	Robotics	Venture Capital	5/4/2023
Model-Prime	2,300,000	Robotics	Seed Round	3/30/2023
ESTAT Actuation	866,000	Robotics	Venture Capital	3/23/2023
TRAINED	865,000	Business Solutions	Seed Round	3/6/2023
StockSnips	125,000	Business Solutions	Venture Capital	2/27/2023
Plus One Robotics	50,000,000	Robotics	Venture Capital	1/17/2023
Allvision	150,000	Artificial Intelligence	Seed Round	1/12/2023
Shift Robotics	329,000	Robotics	General Equity	1/5/2023
Voaige	2,000,000	Artificial Intelligence	Seed Round	1/1/2023

Source: Cushman & Wakefield Research, PitchBook

DECISION MAKING

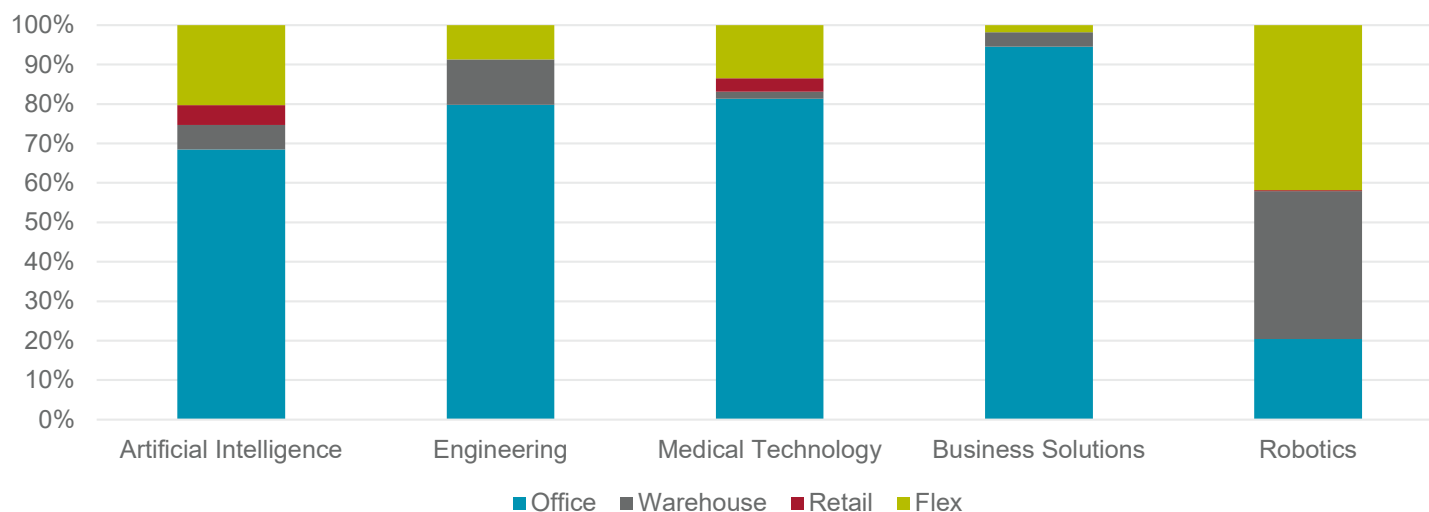
With a comprehensive grasp of the composition of companies in the Pittsburgh region, and the substantial capital inflow into these entities, it is time to delve into the real estate aspect of the equation. Being the second-largest expense for most companies, real estate decisions inherently wield substantial influence. To make well-informed decisions, tech firms must pose a range of critical questions during their search for suitable space. For example, they must consider the general type of space required, specific building attributes, location preferences, and the potential impact of their current or future funding prospects on their leasing arrangements.

Each of these questions is best solved on a case-by-case basis where specific consideration and analysis can be applied. However, on a macrolevel, some general insights on the underlying motivations of tech companies can be uncovered during the decision-making process. A concrete understanding of the motivations behind leasing decisions enables developers and brokers alike to focus services more accurately for tech companies. This cuts down on inefficiencies and even provides a blueprint for what type of space is needed for these tech companies. Space that is tailor-made for tech companies, meeting their every need, will lead to one less hurdle on the path to innovation.

Space Occupied by Industry Horizontal

The first decision a tech firm must make is what type of space to occupy. Based on the requirements of day-to-day operations, tech firms need vastly different types of space. The industry *horizontal* aggregation method breaks out companies based on the type of technology used in day-to-day operations. Obviously different types of technology firms have different space requirements. Figure 15 illustrates the type of space occupied by each horizontal.

Figure 15: Space Occupied by Industry Horizontal



Source: Cushman & Wakefield Research

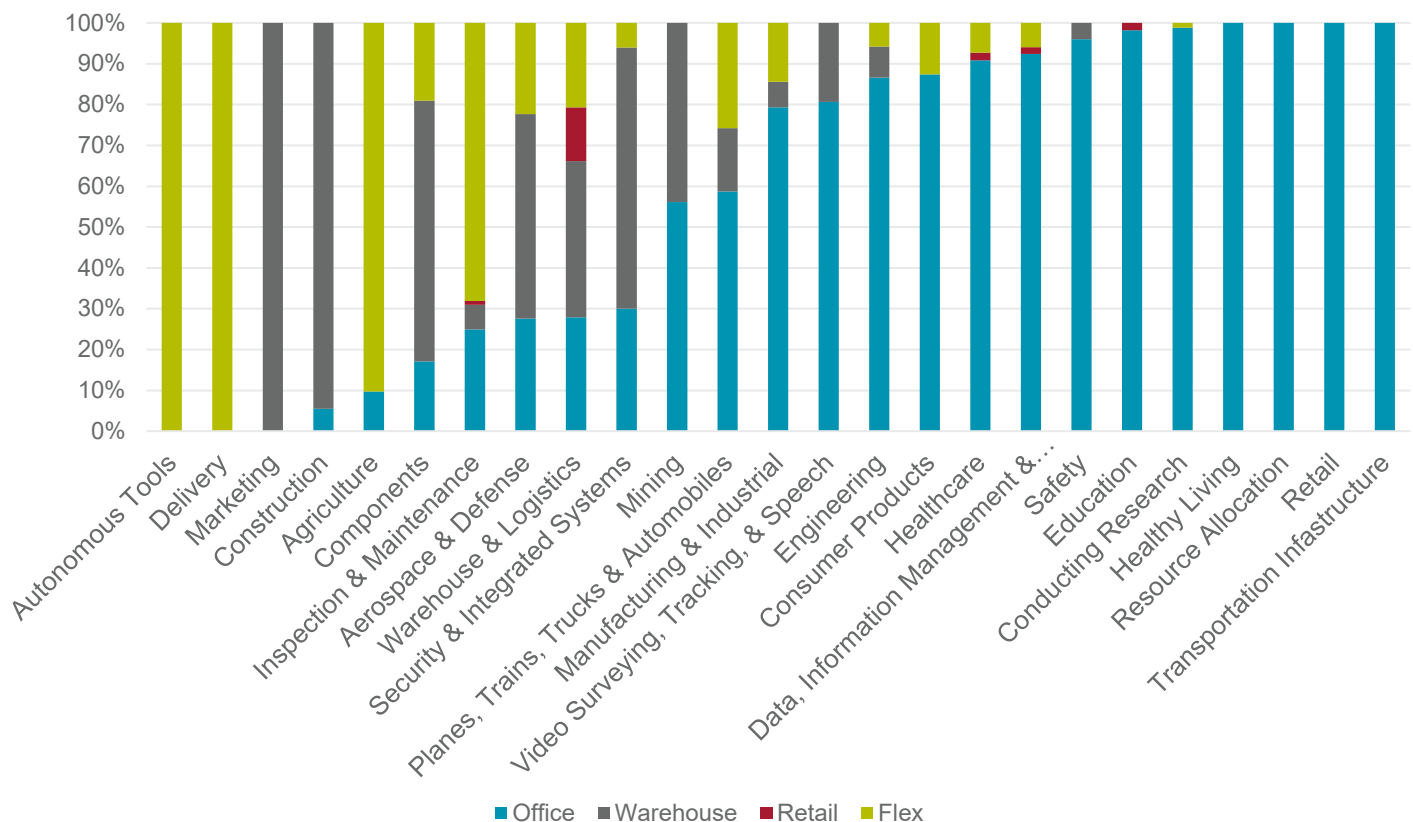
It is immediately evident that the type of space required for each industry *horizontal* varies drastically. This is rather intuitive, as companies developing AI do not have the same space requirements as companies conducting in-house robotics testing. *AI*, *engineering*, *medical technology*, and *business solutions* firms predominately occupy office space. The space occupied by these horizontals is (about or) more than 70% traditional office, with flex, warehouse and retail space filling out the remainder. This is only natural, as firms in these industry horizontals typically only need desks and seats. At the very most, firms in the *AI* and *medical technology* verticals need minimal flex space. This expectation is met, as flex space makes up the second largest type of space occupied.

Contrary to other tech industry horizontals, *robotics* companies occupy mostly warehouse and flex space. In these instances, *robotics* firms need specific building characteristics, such as clear height and power load capacity, to meet the needs of on-sight testing. For example, companies working on drones need high ceiling bays and wide column spacing, allowing for drone maneuverability. These “industrial” requirements lead *robotics* companies more toward industrial space than traditional office.

Space Occupied by Industry Vertical

Having considered the space requirements particular to each horizontal, the same analysis with the industry *vertical* aggregation method will be analyzed. This approach will uncover any verticals that are more inclined toward one space over the other. Since the industry *vertical* approach does not necessarily comment on the type of technology used in day-to-day operations, this analysis comments less on the space needed due to technology constraints and more on what horizontals are more prevalent in each vertical. Ultimately the type of technology used (i.e. horizontal) determines what space is needed. As previously discussed, *AI*, *medical technology*, *business solutions*, and *engineering* horizontals use more than 70% office space. The *robotics* horizontal use 80% warehouse and flex space. Therefore, verticals that are overwhelmingly office are likely comprised of the *AI*, *medical technology*, *business solutions*, or *engineering* horizontals. Conversely, if there is a substantial warehouse and flex presence in a vertical, this suggests a heavy concentration of companies utilizing the *robotics* horizontal. This is insightful as it helps narrow down where the more “hands on” robotics companies are making an impact. Figure 16 details the space occupied by industry *vertical*.

Figure 16: Space Occupied by Industry Vertical



Source: Cushman & Wakefield Research

Aerospace & defense, *agriculture*, *autonomous tools*, *construction*, *inspection & maintenance*, *planes, trains, trucks & automobiles*, *security & integrated systems*, *delivery* and *warehouse & logistics* companies all have a substantial percentage of occupied space in flex and warehouse buildings. Given the previously uncovered relationship between industry horizontal and type of space used, it is implied that these verticals are mostly utilizing robotics technology. This finding is corroborated with direct calculations of the percentage of each industry horizontal within a given industry vertical. Table 2 details the relationship between industry vertical and industry horizontal.

Table 2: Technology Leveraged by Industry Vertical

Industry Vertical	Artificial Intelligence	Medical Technology	Robotics	Business Solutions	Engineering
Aerospace & Defense	0.0%	0.0%	100.0%	0.0%	0.0%
Agriculture	41.7%	0.0%	58.3%	0.0%	0.0%
Autonomous Tools	0.0%	0.0%	100.0%	0.0%	0.0%
Components	0.0%	0.0%	100.0%	0.0%	0.0%
Conducting Research	24.5%	0.0%	75.5%	0.0%	0.0%
Construction	0.0%	0.0%	100.0%	0.0%	0.0%
Consumer Products	20.0%	0.0%	7.0%	73.0%	0.0%
Data, Information Management & Financial	22.0%	0.0%	0.0%	78.0%	0.0%
Delivery	0.0%	0.0%	100.0%	0.0%	0.0%
Education	86.4%	0.0%	7.3%	6.3%	0.0%
Engineering	0.0%	0.0%	0.0%	65.9%	34.1%
Healthcare	5.4%	50.2%	0.0%	44.4%	0.0%
Healthy Living	100.0%	0.0%	0.0%	0.0%	0.0%
Inspection & Maintenance	6.5%	2.5%	91.0%	0.0%	0.0%
Manufacturing & Industrial	0.0%	0.0%	21.5%	78.5%	0.0%
Marketing	100.0%	0.0%	0.0%	0.0%	0.0%
Mining	2.6%	0.0%	0.0%	97.4%	0.0%
Planes, Trains, Trucks & Automobiles	12.0%	0.0%	40.2%	47.8%	0.0%
Resource Allocation	100.0%	0.0%	0.0%	0.0%	0.0%
Retail	39.5%	0.0%	60.5%	0.0%	0.0%
Safety	100.0%	0.0%	0.0%	0.0%	0.0%
Security & Integrated Systems	11.9%	0.0%	72.8%	15.2%	0.0%
Transportation & Infrastructure	2.1%	0.0%	0.0%	0.0%	97.9%
Video Surveying, Tracking & Speech	100.0%	0.0%	0.0%	0.0%	0.0%
Warehouse & Logistics	31.9%	0.0%	24.7%	43.4%	0.0%

Source: Cushman & Wakefield Research

Comparing the two tables, it is evident that industry verticals with high concentrations of warehouse and flex space used are predominately comprised of companies in the *robotics* horizontal. For example, consider the *inspection & maintenance* vertical. Of all the space occupied in this vertical, 74.1% is in either flex or warehouse buildings. Simultaneously, 91.0% of all the companies in this vertical are in the *robotics* horizontal. Verticals with high concentrations of office space occupied are indicative of companies in the remaining horizontals. This result only further solidifies the idea that space occupied is integrally tied to the type of technology used.

Building Specifics: Clear Height

Next, a more granular investigation of the type of space occupied by technology companies will be analyzed. *Robotics* companies tend to occupy substantially more warehouse and flex space than the other technology companies. The utilization of this type of space is likely due to equipment and onsite testing requirements. Given these cumbersome requirements, it is no surprise that robotics companies, on average, occupy space with high ceiling bays. Below is a table detailing the average clear height by industry horizontal.

Table 3: Average Clear Height by Industry Horizontal

Industry Horizontal	Average Clear Height
Artificial Intelligence	11'10"
Engineering	14'4"
Medical Technology	11'11"
Robotics	15'6"
Business Solutions	12'5"

Source: Cushman & Wakefield Research, CoStar

On average, *robotics* companies have clear heights of 15'6", the highest of any industry horizontal. Apart from *engineering* firms, on average, *robotics* companies have clear heights 3'1" higher than the other horizontals. The significantly higher average clear height, in conjunction with known industry requirements, gives credence to the idea that clear height is a significant factor for *robotics* companies, and less so for other tech horizontals.

This idea is only further illustrated when considering average clear heights based on the industry vertical. Companies producing *mining* equipment, *autonomous tools*, and general *components* have average clear heights in excess

of 18'. These companies are mostly geared toward *robotics*. Conversely companies working on *consumer products*, *education*, and *conducting research* have average clear heights under 12'. Most of these firms are in the *AI* horizontal. This dichotomy clearly illustrates the different need for cubic space based on industry vertical. Table 4 is breakout in table form.

Table 4: Average Clear Height by Industry Vertical

Industry Vertical	Average Clear Height
Aerospace & Defense	15'1"
Agriculture	16'4"
Autonomous Tools	15'8"
Components	20'0"
Conducting Research	11'6"
Construction	17'8"
Consumer Products	10'11"
Data, Information Management & Financial	11'8"
Delivery	13'0"
Education	10'10"
Engineering	14'5"
Healthcare	11'1"
Healthy Living	11'0"
Inspection & Maintenance	15'7"
Manufacturing & Industrial	13'0"
Marketing	13'0"
Mining	17'6"
Planes, Trains, Trucks & Automobiles	13'11"
Resource Allocation	11'0"
Retail	11'6"
Safety	11'0"
Security & Integrated Systems	16'0"
Transportation Infrastructure	11'0"
Video Surveying, Tracking & Speech	11'0"
Warehouse & Logistics	15'11"

Source: Cushman & Wakefield Research, CoStar

Building Specifics: Docks, Drive-ins, Power, Freight Elevators, and Sprinklers

Docks and drive-in doors are another building specific *robotics* companies seek out. Table 5 is the breakout of average docks and drive-ins per building occupied by tech companies.

Table 5: Average Docks and Drive-ins by Industry Horizontal

Industry Horizontal	Average Number of Docks	Average Number of Drive-ins
Artificial Intelligence	0.5	0.4
Engineering	0.9	0.7
Medical Technology	0.0	0.1
Robotics	1.2	0.8
Business Solutions	0.7	0.9

Source: Cushman & Wakefield Research, CoStar

Buildings occupied by *robotics* companies have the largest average combination of docks and drive-ins, at two per building. This is rather intuitive as *robotics* companies use the most equipment and machinery, thereby needing a convenient way to receive shipments of said equipment. The need for easy shipping and receiving is not necessarily a dominating criterion in the search for space, as the delta between docks/drive-ins for *robotics* companies and docks/drive-ins for all other tech companies is small. Again, intuitively this makes sense. *Robotics* companies have no need for half a dozen docks, just one or two to make the movement of machinery more efficient.

Table 6 breaks out the average number of docks and drive-ins per building per industry vertical. This provides some insight on the needs of shipping and receiving by industry vertical. For example, the *components* industry vertical average 6.3 docks/drive-ins per building occupied by companies in this vertical. This is intuitive as companies in the *components* vertical have greater need for shipping and receiving materials (it is in the name). Also, recall that 100% of the companies in the *components* vertical are in the *robotics* horizontal too. One noteworthy exception to this relationship is the *marketing* vertical has an average of one dock and four drive-ins despite being exclusively comprised of *AI* firms.

Table 6: Average Docks and Drive-ins by Industry Vertical

Industry Vertical	Average Number of Docks	Average Number of Drive-ins
Aerospace & Defense	0.6	0.1
Agriculture	0.5	2.0
Autonomous Tools	0.7	1.3
Components	5.3	1.0
Conducting Research	0.0	0.0
Construction	0.7	1.7
Consumer Products	0.0	0.0
Data, Information Management & Financial	0.2	0.0
Delivery	0.0	0.0
Education	0.0	0.5
Engineering	0.9	0.7
Healthcare	0.0	0.0
Healthy Living	0.0	0.0
Inspection & Maintenance	0.5	0.4
Manufacturing & Industrial	1.1	0.8
Marketing	1.0	4.0
Mining	0.0	4.0
Planes, Trains, Trucks & Automobiles	0.8	0.7
Resource Allocation	0.0	0.0
Retail	0.0	0.0
Safety	0.5	1.0
Security & Integrated Systems	1.2	2.6
Transportation Infrastructure	0.0	0.0
Video Surveying, Tracking & Speech	3.0	0.5
Warehouse & Logistics	3.3	0.5

Source: Cushman & Wakefield Research, CoStar

Robotics firms may also need to consider the power capacities, number of freight elevators, and presence of sprinklers at a location. However, given the primary need of ample open space leads firms to industrial and flex buildings, the consideration of power capacities, freight elevators and sprinklers becomes secondary. That is, the available stock of industrial and flex buildings is often outfitted with high power capacities, several freight elevators, and working sprinklers.

Company Location

Another important decision to be made is the actual location a company leases. Where should a firm set its base of operations? Downtown Pittsburgh? Oakland? The Suburbs? Companies need to consider several factors, including availability of labor and proximity to the universities. Each firm's needs differ from the next, causing discernable patterns in the establishment of locations by industry horizontal.

One of the major talking points in Pittsburgh is its universities, and how they draw companies to the region. Many startups are born out of the universities, and already established companies vie for proximity to the young talent. Below is a link to a map of technology companies in Pittsburgh segmented by industry horizontal.

[Atlas Robotics Maps](#)

At first glance, the Atlas map supports the claim that the majority technology companies congregate in Downtown Pittsburgh. Table 7 explicitly states this relationship.

Table 7: Company Locations by Submarket

Neighborhood	% of Companies
CBD	4.1%
East End	21.2%
The Strip District	12.9%
Oakland	21.7%
The North Shore	14.7%
The South Side	4.1%
Suburbs	21.2%

Source: Cushman & Wakefield Research

Of all technology related companies, 42.9% are located immediately around the universities (i.e., East End and Oakland). Moreover, 78.8% of all tech companies are located in Downtown Pittsburgh. Table 8 breaks out location by companies' classification.

Table 8: Downtown v. Suburbs by Industry Horizontal

Company Type	Pct Downtown	Pct Suburbs
Business Solutions	78.9%	21.1%
Artificial Intelligence / Software	80.3%	19.7%
Robotics	74.0%	26.0%
Medical Technology	83.3%	16.7%
Engineering	87.0%	13.0%

Source: Cushman & Wakefield Research

Every industry horizontal has over 70.0% of its base located in Downtown Pittsburgh. Table 9 is a more granular look at company type broken out by neighborhood.

Table 9: Submarket Breakout by Industry Horizontal

Neighborhood	Business Solutions	AI / Software	Robotics	Medical Tech	Engineering
CBD	5.3%	3.3%	5.2%	5.6%	0.0%
East End	23.7%	14.8%	28.6%	11.1%	17.4%
Strip District	10.5%	23.0%	7.8%	5.6%	13.0%
Oakland	10.5%	29.5%	23.4%	33.3%	4.3%
North Shore	28.9%	8.2%	6.5%	11.1%	39.1%
South Side	0.0%	1.6%	2.6%	16.7%	13.0%
Suburbs	21.1%	19.7%	26.0%	16.7%	13.0%
Oakland / East End	34.2%	44.3%	51.9%	44.4%	21.7%

Source: Cushman & Wakefield Research

Notice that *robotics*, *AI*, and *medical technology* companies have the highest concentration around the universities. Of all robotics companies, 51.9% are in either the Oakland or East End submarket. Of all AI firms, 44.3% are in either the Oakland or East End submarket. Of all *medical technology* companies, 44.4% are in either the Oakland or East End submarket. From a surface level glance, this is intuitive as these are the more specialized technology companies, often having stronger roots with the universities.technology companies, often having stronger roots with the universities.

The Impact of Funding on Decision Making

Next, the relationship between funding received and company expenditures is examined. Specifically, does increased funding have any downstream effects on square feet leased, employees hired, and quality of space leased?

Below is a table detailing the relationship between funding received and square feet leased.

Table 10: The Impact of Funding on SF Leased

Funding Range (\$ million)	Average SF Leased
Less than \$1	6,222
Between \$1 and \$5	6,933
Between \$5 and \$25	16,648
More than \$25	21,889

Source: Cushman & Wakefield Research, Pichbook

Companies that receive larger sums of funding, on average, have more space. This implies a positive correlation between funding received and square feet leased. However, it does not necessarily verify causation. From a purely statistical perspective, it could be the case that companies with a larger square foot presence tend to receive more funding. However, given the nature of how leasing transactions occur (i.e. you need more money to lease more space), it is reasonable to assume causation. As such, we can conclude that upon receiving more funding, companies look to expand, a rather intuitive result.

Below is a table detailing the relationship between funding received and employees at a company.

Table 11: The Impact of Funding on Employees

Funding Range (\$ million)	Average Employees
Less than \$1	10.0
Between \$1 and \$5	13.9
Between \$5 and \$10	22.3
Between \$10 and \$25	36.6
Between \$25 and \$50	56.0
More than \$50	146.4

Source: Cushman & Wakefield Research, Pichbook



Companies that receive larger sums of funding, on average, employ more workers. This directly implies a positive correlation between funding received and employees hired. However, again, this does not necessarily imply causation from a purely statistical stance. It is entirely possible that having more employees helps a company procure more funding. Though that interpretation has some merit, given the nature of companies to expand after receiving funding, it is reasonable to assume that receiving more funding causes firms to hire more employees.

Below is a table detailing the relationship between funding received and average building class. For the purposes of aggregation, letter grade building classes are transformed into numeric building classes, where Class A equals three, Class B equals two, and Class C equals one.

Table 12: The Impact of Funding on Building Class

Funding Range (\$ million)	Average Building Class (Numeric)	Average Building Class (Letter)
Less than \$1	1.39	C+
Between \$1 and \$5	1.67	B-
Between \$5 and \$25	1.91	B
More than \$25	2.24	B+

Source: Cushman & Wakefield Research, Pichbook

Companies that receive larger sums of funding, on average, occupy higher quality space. Of course, this implies a positive correlation between funding received and quality of space occupied. Once again, from a purely mathematical position, the causation could go either way. There could be some inherent quality of higher-class space that enables companies to procure more funding. Obviously, this interpretation does not make much sense. Moreover, persistent flight to quality trends throughout the entire CRE market indicate that companies seek quality space, and the primary deterring factor is lack of funds. Therefore, it is reasonable to assume that an increase in disposable funds via funding rounds causes a firm to upgrade its space.

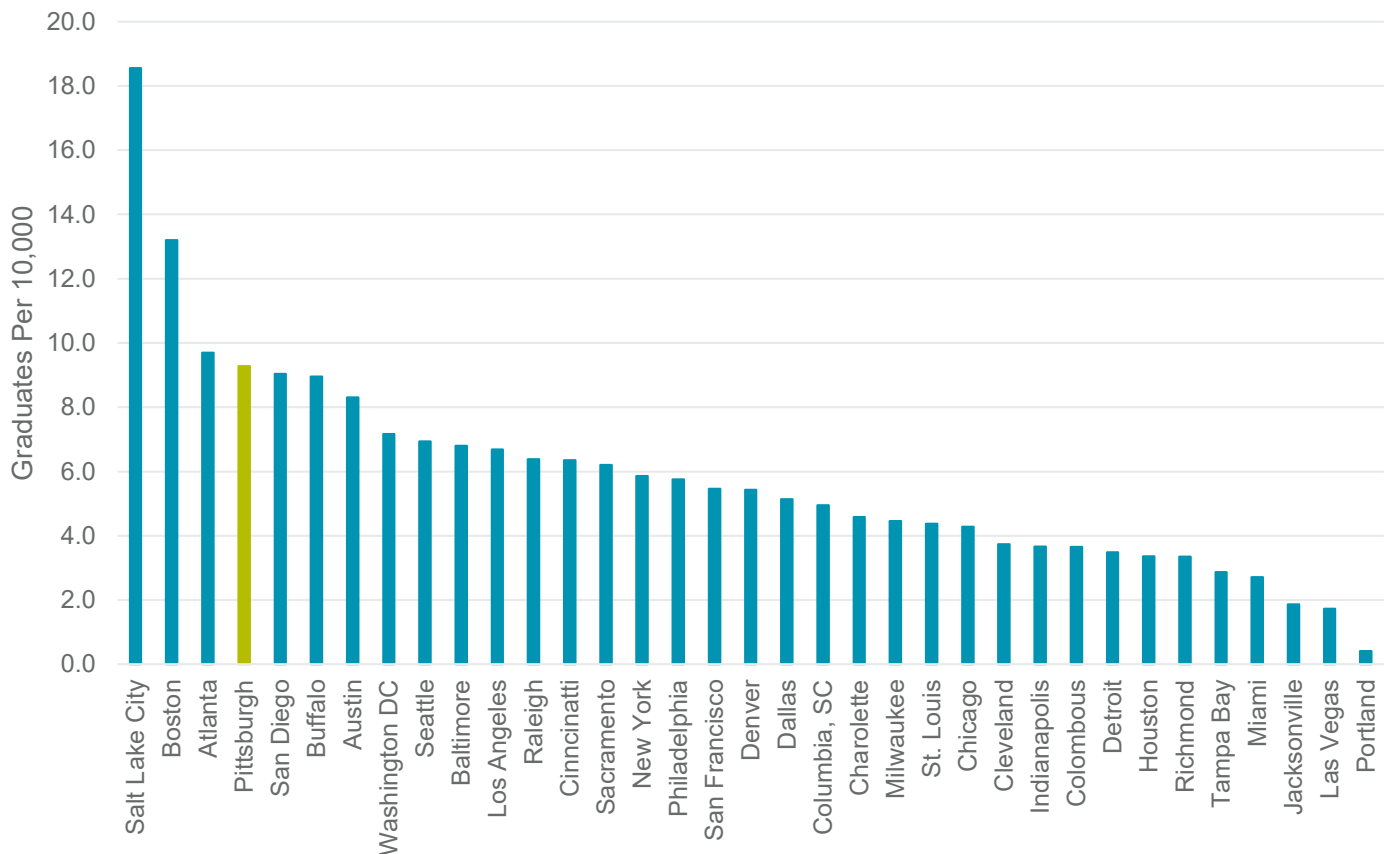
APPENDIX

Supporting the Claim that Pittsburgh is losing the majority of its young tech talent

Perhaps it is a startling claim that many students leave Pittsburgh upon graduation, as many of the regions talking points revolve around the talent the universities bring to the area. The Allegheny County Commerce Council found that roughly half of all graduates leave upon completion. This analysis was done using LinkedIn locations of recent graduates. The analysis focused on students of all majors. Given the wide array of majors, and differing career paths associated with each major, a macro view of the subject is not sufficient to comment on the tech field. That is to say, it is possible that despite the majority of students leaving the region, there is something unique to tech majors that keeps them in the area. As such, further analysis is needed to comment on the patterns of tech graduates.

Of competing metropolitan areas, Pittsburgh has one of the highest tech graduates per capita. Per 10,000 people, Pittsburgh produces 9.28 tech graduates (as of 2021). For context, below is a graph of the competing metros.

Figure A: Tech Graduates Per Capita

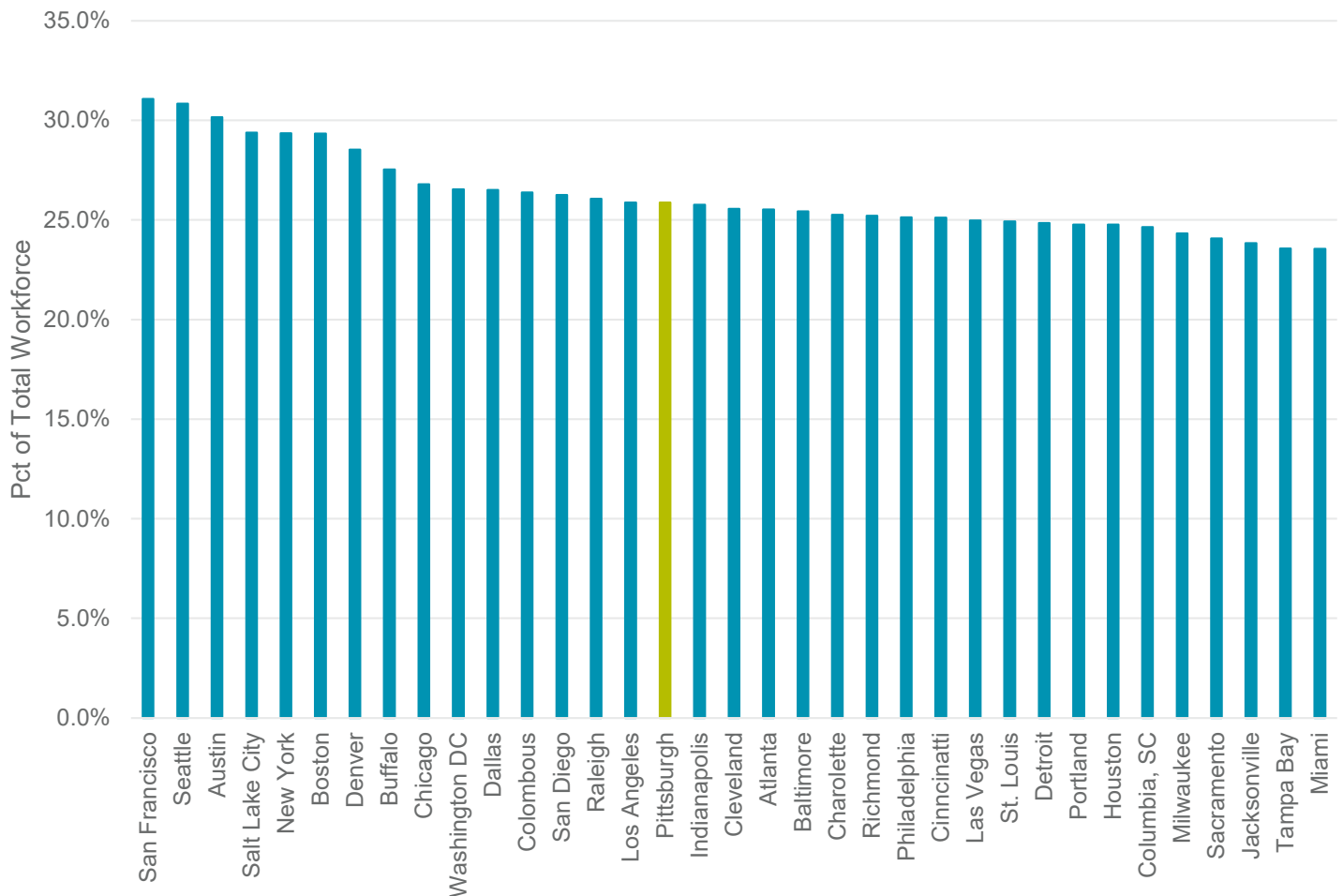


Source: Lightcast

Only Salt Lake City, Boston, and Atlanta produce more robotics and AI geared graduates, per capita, than Pittsburgh.

Simultaneously, of all tech workers in Pittsburgh, 25.9% are ages 25-34. This age cohort represents recent college graduates. For comparison's sake, below are graphs illustrating how Pittsburgh stacks up against other major Metropolitans.

Figure B: Workforce Composition: Age 25-34

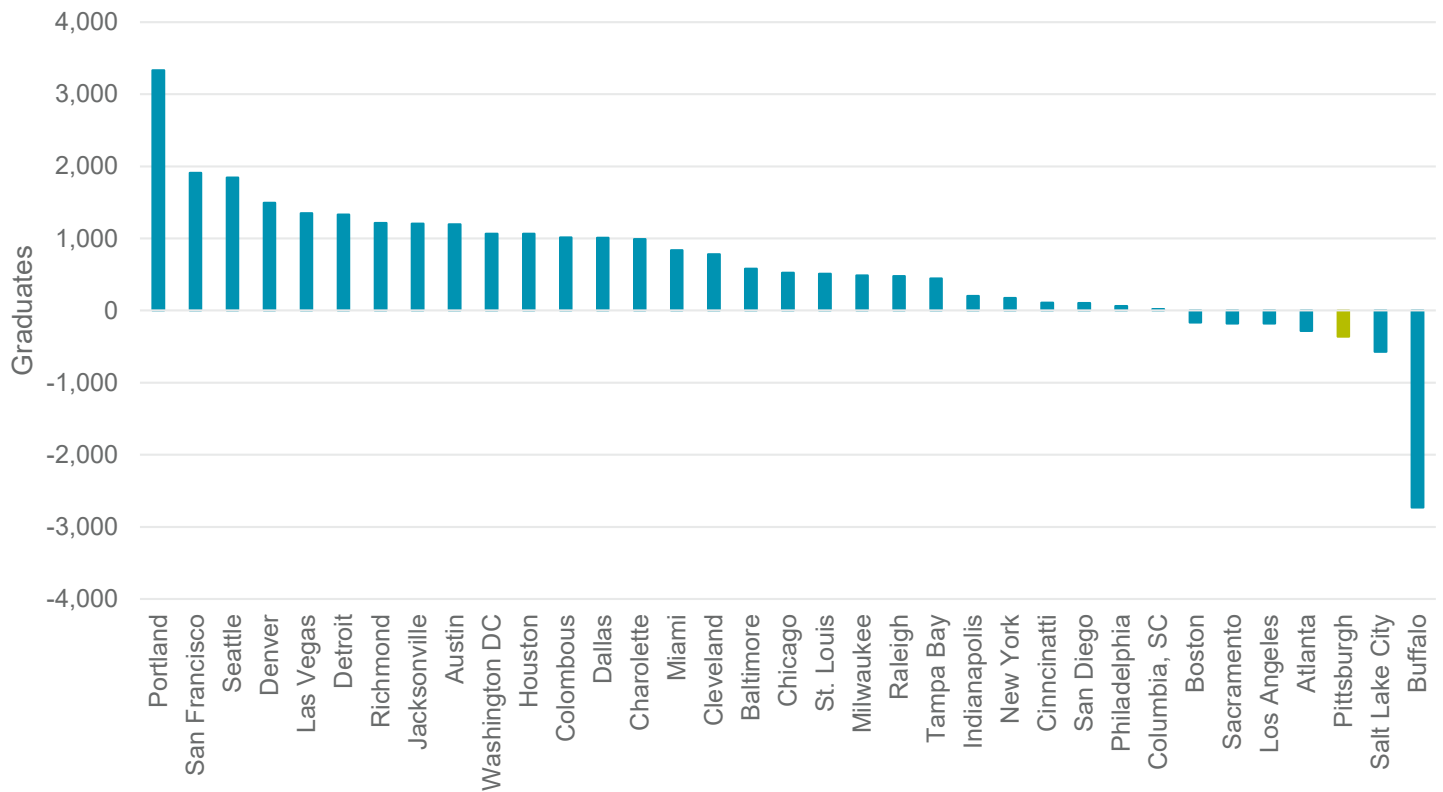


Source: Lightcast

Given that the tech sector is still an emerging industry mostly dominated by young talent, and the universities in Pittsburgh produce such a wealth of young talent, if said talent is staying in the region, it would be expected a larger percentage of the workforce, relative to competing MSAs, would be in the younger age cohorts. The age distribution of Pittsburgh's tech workforce does not coincide with the per capita level of talent the city produces. This seems to suggest that the tech sector is not immune to the broader trend of graduates leaving the region.

More directly, consider a hypothetical scenario in which every graduate stayed in the region of their alma mater. Using graduation statistics from the past ten years, it is possible to construct the size of this hypothetical 25-34 age cohort. With the size of this hypothetical age cohort, and the actual size of employment in the existing tech sector, one can calculate the hypothetical percentage of young talent in the tech sector given relocation does not exist. Then, one can compare the hypothetical percentage of young talent in the market to the actual percentage of young people in the market. The difference between the two statistics acts as a net migration barometer. In Pittsburgh 25.9% of the tech sector employees are in the age range of 25-34. If all recent graduates of Pittsburgh Institutions stayed in the area (and no new workers moved into the area), 29.5% of all tech employees would be in the age range of 25-34. As such, there is a negative 363-basis point (bp) net migration effect. This directly shows that Pittsburgh is losing more tech talent than it is producing/attracting. For Context, below is a graph comparing Pittsburgh to competitive metros.

Figure C: Net Migration of Graduates



Source: Cushman & Wakefield Research and Lightcast

Only Salt Lake City and Buffalo lose more young talent than Pittsburgh. Whereas West Coast cities like Portland, San Francisco and Seattle attract far more talent than they produce/lose. Pittsburgh’s net negative migration effect for tech related industries coincides with the broader narrative that the majority of students leave the area upon graduation.

Average Age

Below are charts detailing the average age of companies based on each classification method. This breakout gives the reader an idea of what stage in the business cycle the majority of companies in these groups are currently in.

Table A: Average Age by Industry Horizontal

Industry Horizontal	Average Age (Yrs)
Artificial Intelligence	10.9
Engineering	59.0
Medical Technology	19.0
Robotics	18.8
Business Solutions	38.0

Source: Cushman & Wakefield Research

Table B: Average Age by Industry Vertical

Industry Vertical	Average Age (Yrs)
Aerospace & Defense	19.3
Agriculture	32.2
Autonomous Tools	36.0
Components	5.6
Conducting Research	15.1
Construction	13.9
Consumer Products	17.7
Data, Information Management & Financial	14.5
Delivery	11.9
Education	16.8
Engineering	60.7
Healthcare	16.0
Healthy Living	7.9
Inspection & Maintenance	9.0
Manufacturing & Industrial	42.9
Marketing	17.6
Mining	36.9
Planes, Trains, Trucks & Automobiles	49.5
Resource Allocation	5.4
Retail	9.2
Safety	15.6
Security & Integrated Systems	23.9
Transportation Infrastructure	34.6
Video Surveying, Tracking & Speech	14.8
Warehouse & Logistics	20.6

Source: Cushman & Wakefield Research

Obviously, companies in the *planes, trains, trucks & automobiles* have not been working on autonomous driving technology for the entire duration of the vertical's existence

Table C: Average Age by Impact

Industry Impact	Average Age (Yrs)
Changing the Way We Live	13.4
Changing the Way We Move	40.2
Changing the Way We Work	20.2
Conducting Research	19.3
Enabling Autonomy	17.4

Source: Cushman & Wakefield Research

METHODOLOGY

How were the technology companies included in the analysis decided?

Working with the Pittsburgh Robotics Network (PRN) and the Allegheny Conference, all companies in Pittsburgh belonging to the PRN were identified. Moreover, using PitchBook's industry vertical classification system and general Google searches of technology companies in the Pittsburgh area, a prospective company list was created. The companies on this prospective company list were then researched to see if they met the necessary qualifications to be considered as a relevant tech company. The general criteria for what constitute a relevant tech company was whether or not the company's production fits into the narrative of Pittsburgh being a district of innovation. Several judgement calls needed to be made. This process led to the final list of tech companies used in the report. Only companies that are actively operating in the Pittsburgh area were included.

How were companies classified based on Impact?

The impact classification method classifies companies based on what facet of society the technology would change. This method is borrowed from the PRN. The PRN had already classified all of the companies belonging to the network. For companies included in this report, but not in the PRN, they were thoroughly researched the technology being produced. Then a judgement call was made on how that technology would impact society. Based on that judgement call, these companies were classified in one of six categories (identified in the paper).

How were companies classified based on Horizontal?

The horizontal classification method classifies companies based on the type of technology used. All the companies and types of technology used in the report were thoroughly researched. Based on the information, mostly from company websites, the companies were classified. The intent was to keep the classification method broad, but still meaningful.

How were companies classified based on Vertical?

The vertical classification method classifies companies based on the use of the end product. Again, each company was thoroughly researched, finding out exactly what it produces. Based on the end product, a list of industry verticals was created that accurately represents each company.

How was the type of space used by companies identified?

Once a list of companies to include in the report was identified, it was determined where each company is located. Then through a variety of resources (including but not limited to proprietary information, website data, CoStar, and field visits) it was determined how much space each company occupies. Then using commercial real estate intel of the buildings occupied, as well as floor plans of lesser-known buildings, it was determined how much of each type of space the company occupies.

How was funding data gathered?

An initial search for funding in PitchBook of all the companies included in the report was produced. Information on the dollar figure received, the type of funding received, and the date of funding was gathered. Then Google searches were conducted to verify the funding information from PitchBook and fill in any gaps in the data. In these Google searches, article publications of the announcement of funding rounds for the companies of interest were uncovered. Only funding for companies that are actively operating in Pittsburgh was included. Moreover, only funding for companies that are headquartered (or have a significant presence) was included in the aggregation presented in the paper.

How was the information on tech companies' connection to local universities gathered?

As part of the background research for each company, the founding members and current executive, operating, and financial officers were identified. Next, the educational background of these founding members' and executives' were researched. It was noted if ANY of these members had an educational background at local Pittsburgh universities (i.e., CMU and Pitt).

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