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STATE OF THE INDUSTRY

2019

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STATE OF THE INDUSTRY 2019

ATTRACTING TALENT:
LET'S TRY SOMETHING VERY NEW

By **Audrey Russo**, President and CEO, Pittsburgh Technology Council

FOR OVER A DECADE, I HAVE BEEN LUCKY TO HAVE A FRONT-ROW SEAT WITH A PANORAMIC VIEW OF THE ECONOMIC CHANGES ACROSS OUR REGION.

I serve on boards that strengthen my understanding of the complex fibers that tether our collective attempts to build a diverse community with sophisticated amenities of what composes a "place."

I work with regional leaders at the intersection of public-private collaborations with the intentions of accelerating Pittsburgh's "place" as a global city. I witness the passion of entrepreneurs who strive to launch their ideas into lucrative companies that provide employment.

I also meet with people who are thrilled to build their businesses here and want to hire people, across a wide range of skills, but in particular those who have skills that the entire globe is also seeking. Robotics, aerospace, data scientists, machine learning, natural language processing, bio informatics, computer scientists and product managers...the list of sophisticated needs seems endless.

So rather than continue on our business as usual, talking about talent needs, The Pittsburgh Technology Council is going to engage with its membership and listen to who they are trying, as solo entities, to recruit for many of these precise opportunities, which are required to scale disruptive and lucrative companies.

We are going to interview new Pittsburgh transplants, which have come here to take these jobs. We are going to use human-centered design principles to extract what we hear and overlay it into what we can do – as a tech community. Separately and simultaneously, we are going to convene leaders and founders who actually recruit for their companies, to not just understand what they have been doing, but what they want to be doing to ensure that Pittsburgh is a go-to place for incredible work opportunities.

By running these sessions throughout the summer, with our members who make these decisions, paired with our long-standing knowledge of the tech ecosystem, we will then launch a three-year executable plan to focus on the brand of tech and innovation in Pittsburgh through recruitment strategies coupled with brand development. We have to take our specific sector and become more targeted in conveying the stories of work, life and opportunities that articulate our assets, which are unique, but also compelling for many. The world just doesn't know what's percolating here despite our continued mention in top place rankings.

The population of the Pittsburgh remains flat and in the city, slightly shrinking. Shocking when you look at the Strip, Lawrenceville and East Liberty. But it is. And when you compare our population trajectory compared to our benchmark cities, you have to wonder how our top-ranking stories really align with the data.

Remember, the people we are attracting are inquisitive, knowledgeable, highly educated and rely on an assortment of intelligence to acquire their information. The notion of a shrinking city combined with the legacy of old world manufacturing has left an indelible mark on our courageous and bold history. We have to work with laser focus to upend our reputation AND we have to do it now AND we have to do it differently.

If your company is interested in participating in this work with us, email me. If you have ideas, email me. The same old, is not going to morph us into the new.

As you look at our latest *State of the Industry* data in this issue, it will become quickly apparent that Pittsburgh will need a lot of talented people if it is going to flourish.

Reach me at arusso@pghtech.org.

Audrey Russo

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Ashley Steckel

ADVERTISING SALES
MC McKee

PROOFREADER/COPY EDITOR
Elizabeth Byrnes, Chris McClure

DESIGN
Studio Joe

PRINTING
Heeter

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MAIN NUMBER: 412. 687. 2700
FAX NUMBER: 412. 687. 5232
E-MAIL: info@pghtech.org
WEB SITE: www.pghtech.org

MEMBER SERVICES:
Brian Kennedy 412.918.4297

SPONSORSHIP/ADVERTISING SALES:
Ashley Steckel 412.918.4281

EDITORIAL:
Jonathan Kersting 412.918.4295

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STATE OF THE INDUSTRY 2019

Industry Data Compiled by Kevin Lane

TECH INDUSTRY CONTINUES POSITIVE GROWTH TRENDS IN TOTAL ANNUAL PAYROLL AND AVERAGE WAGES, ALTHOUGH WITH SOME EXCEPTIONS.

This year's State of the Industry Report compares three years of data for each of six main technology industry clusters for three years ending 2017, the latest year for which complete data was available.

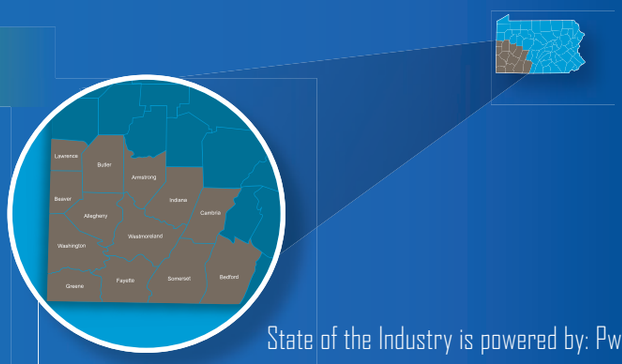
Most technology industry clusters experienced positive growth in total annual payroll with life sciences (excluding health services) leading the way, gaining 12.7 percent over a three-year period.

When considering health services as part of the life sciences cluster, it is important to note that its total annual payroll is the largest in this report at nearly $7.4 billion. It also has the highest number of employees at more than 106,500.

The percentage growth of information technology over a three-year period was a close second, with a gain of 12.4 percent.

Although advanced and technology-intensive manufacturing and energy technology showed slight declines in the number of establishments and total numbers of employees, each tech cluster posted considerable three-year gains in average wages.

Special thanks to the Center for Workforce Information & Analysis, part of the Pennsylvania Department of Labor and Industry.



State of the Industry is powered by: PwC

Southwestern Pennsylvania counties in the Pittsburgh region tracked for this report include Allegheny, Armstrong, Beaver, Bedford, Butler, Cambria, Fayette, Greene, Indiana, Lawrence, Somerset, Washington and Westmoreland.

The Pittsburgh Technology Council keeps records of a complete list of currently used NAICS codes for each subcluster in this report.

HIGHLIGHTS:

- The **9,776 technology establishments** tallied in the year 2017 represent **more than 13 percent of all companies in the 13-county region.**
- These firms **employ 296,833 individuals** and account for nearly **23.4 percent of the area's overall workforce.**
- The **$23.4 billion annual payroll** of technology and related companies, including the health services subcluster, represents more than **34.9 percent of the region's total wages.**

Data may be restated from previous years' reports due to late or revised filings, as well as reclassification of NAICS codes.

INFORMATION TECHNOLOGY

HIGHLIGHTS:

- **77 hardware establishments** within the 13-county region employ **3,475 people** with a total annual payroll of more than **$281 million**, which is $11 million more than the previous year.
- More than **1,030 software establishments** employ more than **15,514 people** with a total annual payroll exceeding **$1.5 billion,** which was $14 million more than the previous year. This subcluster represents the most significant positive change in IT, with **growth of nearly 12 percent** over a three-year period.
- **494 telecommunications firms** employ **11,409 people** in the 13-county region with a total annual payroll in excess of **$1 billion.** Telecom payroll represents the most significant positive change in the IT industry cluster, with **growth of more than 15 percent** over a three-year period.

Component industries:

- Hardware
- Software
- Telecommunications

AGGREGATED
Information Technology Cluster
– 13 Counties –

Year	Establishments	Employment	Total Annual Payroll	Average Wages
2015	1,578	29,712	$2,522,528,104	$84,899
2016	1,596	30,933	$2,713,852,417	$87,733
2017	1,602	30,398	$2,835,759,199	$93,287
Percent change 2015–2017	+ 1.5	+ 2.3	+ 12.4	+ 9.9

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LIFE SCIENCES

HIGHLIGHTS:

- **70 medical equipment and supply manufacturers** within the 13-county region employ **1,251 people** with a total annual payroll of nearly **$63.8 million.**
- **48 instrument and device makers** employ **4,825 people** with a total annual payroll of more than **$381 million,** an increase of $28 million over the previous year. In fact, with a three-year growth pattern of 21.5 percent, the total wage growth in this subcluster is the highest measured in this report.
- **259 bioresearch establishments** employ **11,222 people** with a total annual payroll nearly **$1.1 billion.**
- **16 pharmaceutical companies** employ **366 people** with a total annual payroll of **$20.4 million,** an increase of 14 percent over three years.
- With a **total annual payroll of more than $7.3 billion** and **106,576 employees,** health services is by far the largest subcluster tracked in this report, and as such, it requires a separate examination in addition to the aggregated life sciences cluster. *(See charts.)*

Component industries:

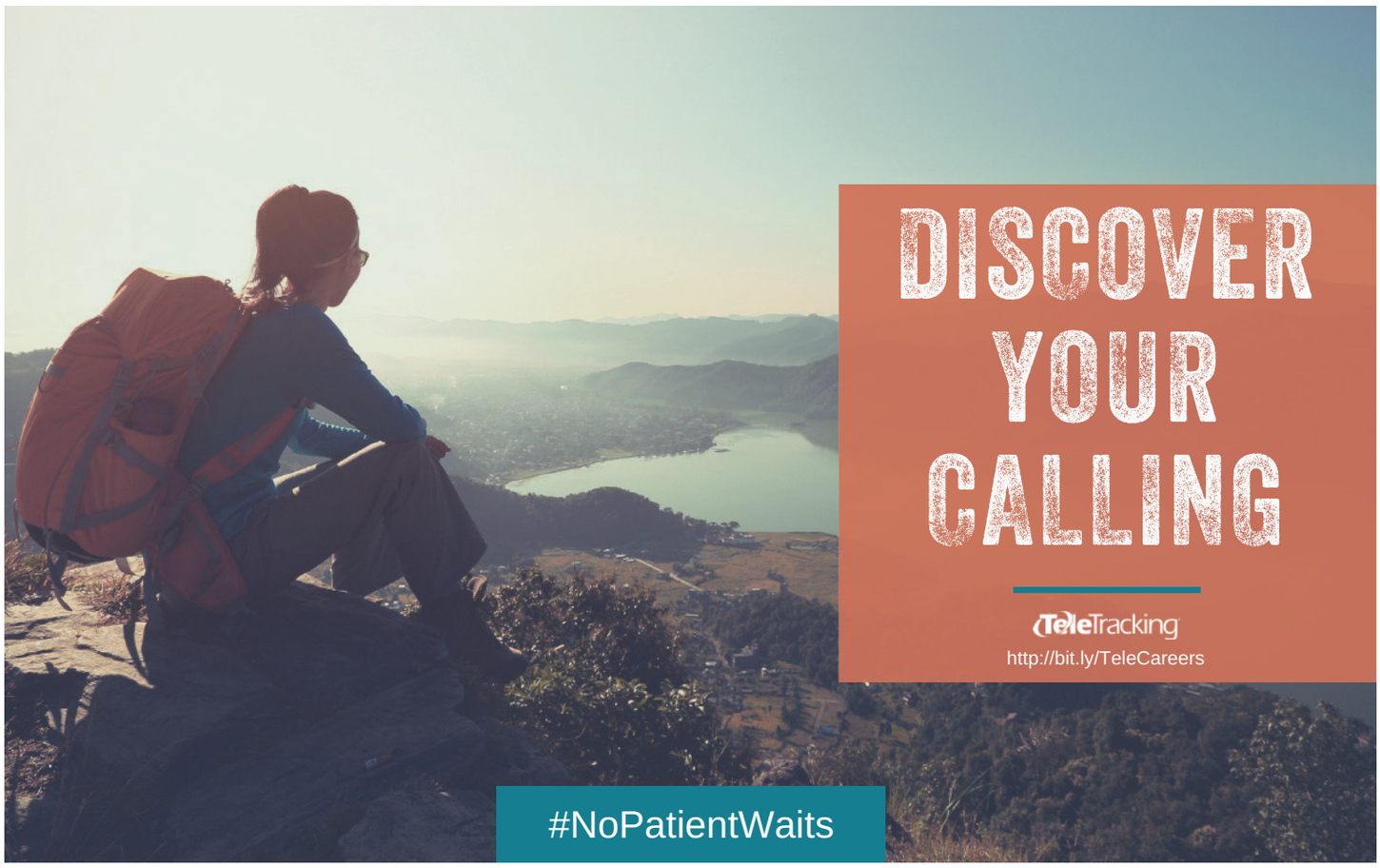
- Medical Equipment and Supplies
- Instruments and Devices
- Bio Research
- Pharmaceuticals
- Health Services

AGGREGATED
Life Sciences Cluster
– 13 Counties –

Year	Establishments	Employment	Total Annual Payroll	Average Wages
2015	397	16,736	$1,421,747,736	$84,951
2016	405	17,496	$1,499,771,938	$85,721
2017	393	17,664	$1,602,404,305	$90,716
Percent change 2015–2017	- 1.0	+ 5.5	+ 12.7	+ 6.8

AGGREGATED
Health Services Subcluster
– 13 Counties –

Year	Establishments	Employment	Total Annual Payroll	Average Wages
2015	2,869	105,188	$7,057,059,344	$67,090
2016	2,815	105,531	$7,118,295,389	$67,452
2017	2,759	106,576	$7,396,062,820	$69,397
Percent change 2015–2017	- 3.8	+ 1.3	+ 4.8	+ 3.4



ADVANCED MANUFACTURING

HIGHLIGHTS:

- There are **785 advanced manufacturers** within the 13-county region that employ more than **22,169 people** with a total annual payroll of more than **$1.4 billion,** which was an increase of $120 million from the previous year.
- The technology-intensive manufacturing subcluster generally encompasses heavier industries, yet with a high degree of science and engineering employees. This subcluster accounted for nearly **1,324 establishments** and employed **42,303 people.** The total annual payroll for this subcluster was more than **$3.4 billion** in 2017, an increase of $200 million from the previous year.

This cluster encompasses industries that are largely automated and that employ a high degree of information technology and process controls, such as computer numerical control systems, as well as employees that are scientists and engineers.

AGGREGATED
Advanced and Technology-Intensive Manufacturing Cluster
– 13 Counties –

Year	Establishments	Employment	Total Annual Payroll	Average Wages
2015	2,145	66,596	$4,720,197,804	$70,878
2016	2,137	64,051	$4,586,083,569	$71,600
2017	2,109	64,472	$4,944,212,512	$76,687
Percent change 2015–2017	- 2.3	- 4.1	+ 3.3	+ 7.7

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ADVANCED MATERIALS

HIGHLIGHTS:

- **147 rubber and plastics manufacturers** within the 13-county region employ **7,066 people** with a total annual payroll of more than **$403 million**, an increase of $36 million from the previous year. This subcluster's payroll grew 8.5 percent over a three-year period.
- **92 chemical manufacturers** within the 13 counties employ **2,691 people** with a total annual payroll of nearly **$194 million.**

Component industries:

- Chemicals
- Plastics and Rubber

AGGREGATED
Advanced Materials Cluster
– 13 Counties –

Year	Establishments	Employment	Total Annual Payroll	Average Wages
2015	254	10,170	$602,863,710	$59,279
2016	246	9,944	$572,611,513	$57,583
2017	239	9,757	$597,729,870	$61,262
Percent change 2015–2017	- 5.9	- 4.1	- 0.8	+ 3.3

ENERGY TECHNOLOGY

HIGHLIGHTS:

- The energy industry in the 13-county region has **1,025 establishments** employing **32,332 people** with a total annual payroll in 2017 just over **$3 billion,** an increase of more than $400 million over the previous year.

Component industries:

- Coal - Petroleum and Natural Gas
- Power Storage - Nuclear - Hydroelectric

AGGREGATED
Energy Technology Cluster
– 13 Counties –

Year	Establishments	Employment	Total Annual Payroll	Average Wages
2015	1,055	35,399	$3,067,473,929	$86,654
2016	1,047	30,017	$2,615,714,351	$87,141
2017	1,025	32,332	$3,057,682,400	$94,571
Percent change 2015–2017	- 2.9	- 8.7	- 0.3	+9.2

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ENVIRONMENTAL TECHNOLOGY

HIGHLIGHTS:

- **36 environmental equipment manufacturers** employ **1,970 people** in the 13-county region with a total annual payroll of more than **$145 million**.
- **327 waste remediation and management establishments** within the 13 counties employ **4,070 people** with a total annual payroll of nearly **$235 million,** an increase of $12 million over the previous year.
- **1,286 professional service and research establishments** employ **29,594 people** with a total annual payroll of nearly **$2.6 billion** in the 13-county region.

Component industries:

- Environmental Equipment
- Remediation and Waste Management
- Professional Services and Research

AGGREGATED
Environmental Technology Cluster
– 13 Counties –

Year	Establishments	Employment	Total Annual Payroll	Average Wages
2015	1,671	37,210	$2,976,989,486	$80,005
2016	1,660	36,706	$2,968,994,842	$80,885
2017	1,649	35,634	$2,974,602,609	$83,477
Percent change 2015–2017	- 1.3	- 4.2	- 0.8	+ 4.3

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OTHER GROWTH FACTORS

A region's technology economy is described by a variety of indicators beyond the number of companies, jobs and wages. This section illustrates the other important measures that help influence southwestern Pennsylvania's strength and pace of technology growth.

UNIVERSITY RESEARCH AND DEVELOPMENT

HIGHLIGHTS:

- University spending in 2017 totaled **$1.47 billion**, an **increase of 5.6 percent** over a three-year period.
- The region's R&D spending is fueled principally by research and development activity in the life sciences, predominately at the University of Pittsburgh. Pitt was **ranked 16th among 900 colleges and universities nationwide** with total R&D expenditures in 2017 at more than **$939 million,** nearly $50 million more than the previous year.
- The University of Pittsburgh **ranked 10th nationally in life sciences** R&D spending, funded mostly through the U.S. Department of Health and Human Services. Of all R&D expenditures at Pitt, 71 percent was devoted to life sciences.
- **Math and Computer Science** is the second largest discipline in the region, as Carnegie Mellon University generally is acknowledged to be among the **top three computer science schools in the nation,** along with Stanford University and M.I.T. Carnegie Mellon was ranked **71st** in 2017 with **$328 million** in R&D expenditures, an increase of 35 percent over three years.
- Carnegie Mellon consistently ranks among the top U.S. universities without a medical school in the number of startup companies per research dollar spent.
- Expenditures at the Software Engineering Institute (SEI), the region's lone Federally Funded Research and Development Center (FFRDC) is examined separately and reached nearly **$133 million** in 2017.
- The SEI is the only one of 42 FFRDCs focusing specifically on software-related security and engineering issues.
- Research expenditures at Duquesne University **exceeded $17 million** in 2017.

The level of research and development spending at local universities and research centers can have a great impact on the development and success of technology firms. Throughout the United States, there are strong examples of positive links between research universities and high technology industries, especially since they both are involved in drawing large amounts of investment capital and talent.

Within this context, it is significant that Pittsburgh is home to two of the largest research universities in the region, the University of Pittsburgh and Carnegie Mellon University. Duquesne University and Indiana University of Pennsylvania also continue in a tradition of R&D spending, although not to the magnitude of Pitt and CMU.

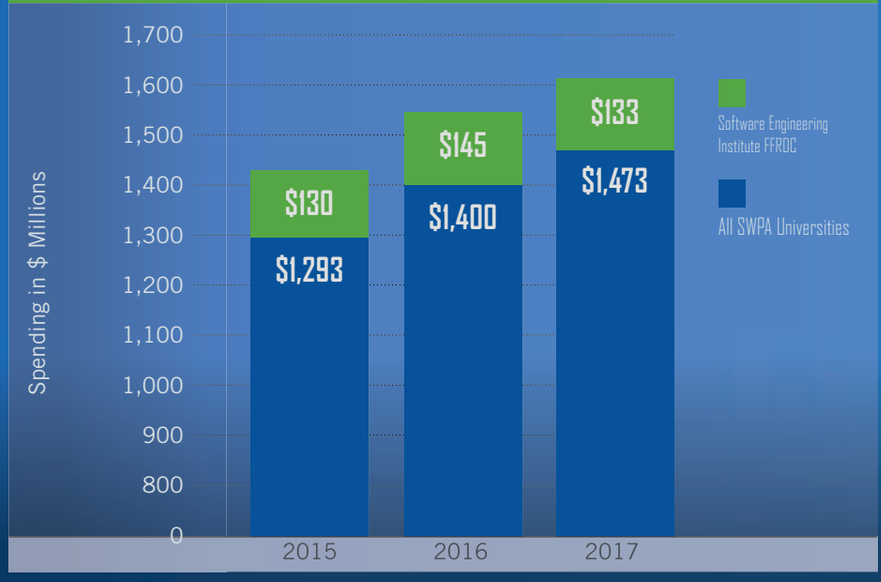
Prior to 2012, other local universities also had contributed to research, but on a lesser scale. Since then, these institutions have not reported any R&D expenditures or have not made the current National Science Foundation cut-off of the top 900 universities it tracked.

In addition, although technically not located within the 13-county southwestern Pennsylvania geographic region, West Virginia University and the Wheeling Jesuit College are close enough to the Pittsburgh MSA to be considered for inclusion in this cohort.

Sources of funds counted in this section include federal, state and local governments, institutions' funds, business, non-profits and other sources.

R&D Expenditures at Universities and Colleges
Including Federally Funded Research and Development Center (FFRDC)

2015–2017
Pittsburgh Region



Source: National Science Foundation/National Center for Science and Engineering Statistics, Higher Education Research and Development Survey of 900 institutions of higher learning in the U.S. and its territories for fiscal year 2017. Data for years 2015 through 2017 includes Carnegie Mellon University, Duquesne University, Indiana University of Pennsylvania, Penn State Beaver, West Virginia University, Wheeling Jesuit University and the University of Pittsburgh.

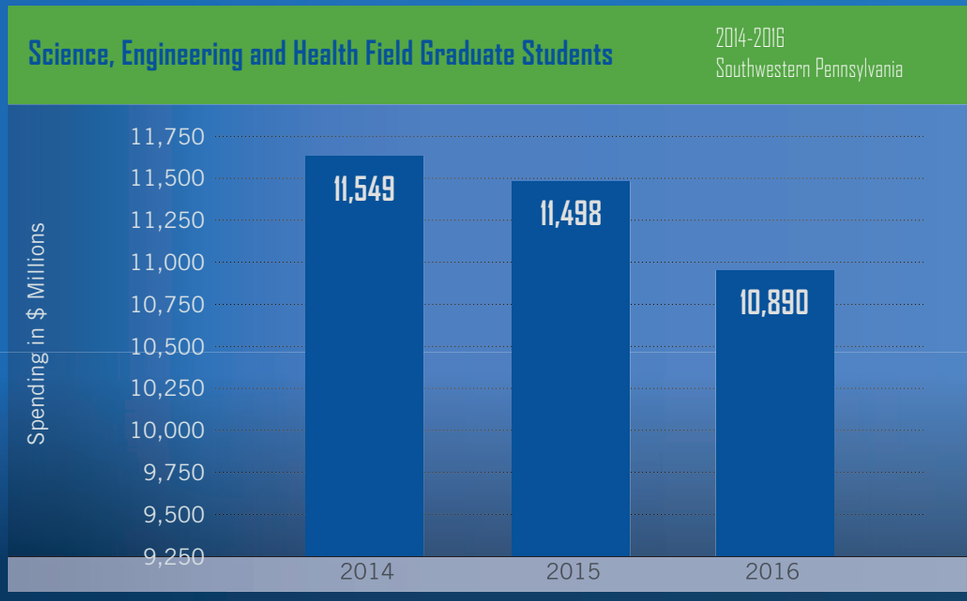
The Software Engineering Institute is the only FFRDC in the region, and it is funded separately from the universities. Values from previous years may have been restated, due to late reporting and/or accounting revisions.

SCIENCE, ENGINEERING AND HEALTH FIELD GRADUATE STUDENTS

HIGHLIGHTS:

- Altogether, seven regional universities accounted for **10,484 science, engineering and health field graduate students** in 2016, the last year for which complete data is available.
- Both Carnegie Mellon University and the University of Pittsburgh accounted for **78 percent of the 13-county total** in 2016.
- West Virginia University is included in the totals for this report, because of its close proximity to and economic influence on the southwestern Pennsylvania region. The University accounted for approximately **13 percent of the total**.
- Indiana University of Pennsylvania, Duquesne University, Chatham University, Slippery Rock and Point Park combined contributed the remaining **nine percent of the region's total** science, engineering and health field graduate students in 2016.

The number of science and engineering graduate students that any region's colleges and universities enroll each year continues to be an important drawing card in attracting and expanding technology development, particularly when the likes of Amazon is looking for a second headquarters location. Companies wishing to establish a presence in any given locale will examine the number of graduate students produced by nearby science and engineering, as well as health field departments, as a ready source of technology talent.



Source: National Science Foundation Graduate Students in Science, Engineering and Health Fields in Doctorate-granting Institutions. Data includes Carnegie Mellon University, Chatham University, Duquesne University, Indiana University of Pennsylvania, Slippery Rock University, Point Park University, The University of Pittsburgh and West Virginia University. Results may have been restated from previous years' reports.

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UNIVERSITY-BASED TECHNOLOGY TRANSFER

HIGHLIGHTS:

- Although the number of patents filed in any given year may vary widely, the fluctuation can be attributed to coincidence. It still indicates the underlying robustness of ongoing innovative activity and discovery. In this regard, the previous year's posting was a record year for filings.
- The U.S. Patent and Trademark Office awarded the University of Pittsburgh **98 new U.S. patents** in 2018.
- The number of start-up companies at the University of Pittsburgh hit a **new record at 23** in 2018, and **financing and equity secured totaled $18.6 million.**
- Third-party investments at the University of Pittsburgh **totaled $1.23 billion,** since its program's inception in 1997, an **increase of $200 million** over the previous year.
- Similarly, venture capital funding for direct start-ups at Carnegie Mellon University **reached $1.4 billion since 2011,** and **70 percent of that investment stayed with Pittsburgh-based companies.**
- In 2018, Carnegie Mellon received **$19.4 million in gross license income,** which accounted for 72 percent of all regional institutions for that year.
- In a study of 200 universities throughout the U.S., the Milken Institute **ranked Carnegie Mellon 10th and the University of Pittsburgh 24th** with regard to robustness of tech transfer. Pitt had advanced from the 35th rank since Milken's previous report in 2006.

University technology transfer activity represents the vehicle by which science and technology developed at the universities is translated into commercial ventures. Aspects of technology transfer are indications of the value that is realized from university research, and as such, they are vital components of regional economic development.

University Technology Transfer in Southwestern Pennsylvania 2016 - 2018

Year	2016	2017	2018
Patents Filed	538	578	343
Patents Issued	145	186	180
Licenses & Options Executed	588	613	406
Gross License Income	$23.3 Million	$14.6 Million	$26.6 Million
Start-up Companies	33	26	34

Source: Carnegie Mellon University, the University of Pittsburgh, and Duquesne University. Since 2009, Duquesne University had adopted the "Carolina License," which offers a no-cost, royalty-only option (license) to spur more regional start-ups. Consequently, not much, if any, license income is anticipated in the short term. Data for Licenses, Options and Other Agreements Executed provided by the University of Pittsburgh and Duquesne University represent a total that includes regular licenses/options executed, sublicenses and licenses that fall under inter-institutional agreements in which the University is not the lead institution. These non-regular license/options are termed "other agreements." The new metric reflects a change by the Association of University Technology Managers in counting licenses/options.

Efficient and Effective Solutions

Dickie McCamey's Derrick Maultsby, Jr. & Jason Ott

The Tech & Data Group of Dickie, McCamey & Chilcote, P.C. presents a diverse team approach to provide a wide range of legal services to companies and entrepreneurs involved in the innovative, constantly developing technology and data industries.

Dickie McCamey

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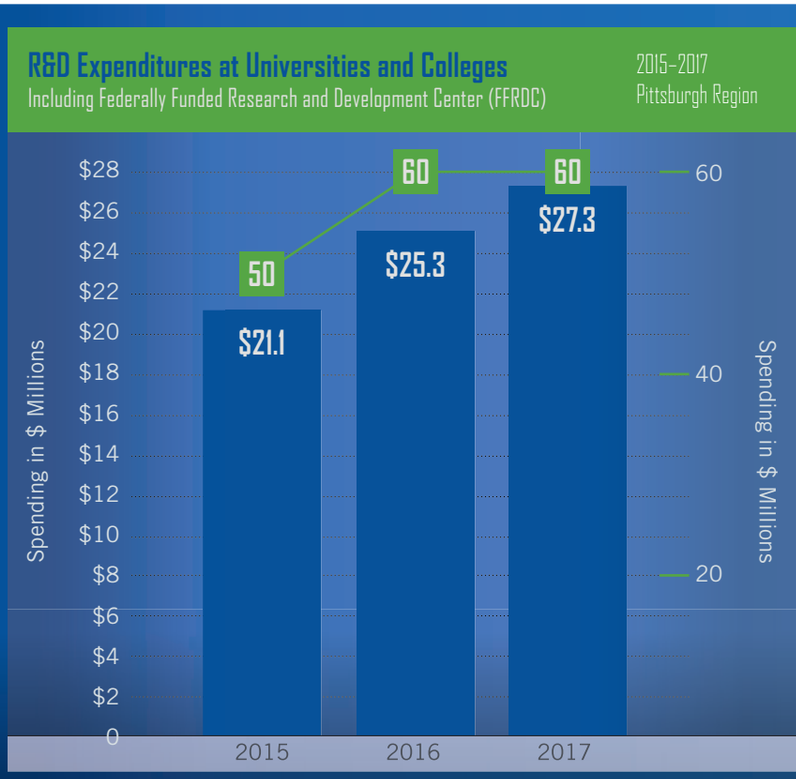
SBIR/STTR AWARDS



HIGHLIGHTS:

- Among the 13 counties, the total dollar values increased in 2017, with **60 awards** totaling $27.3 million, an **increase of eight percent** over the previous year.

The Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs are a large source of early stage technology financing, and it encourages the development and commercialization of new technology products and services by funding small, technology-based companies that are performing cutting-edge research.

Under the SBIR program, federal agencies with more than $100 million in their extramural R&D budgets must have set aside 3.2 percent for partnerships with private industry. Within the STTR program, agencies with one-billion-dollar budgets are required to set aside 0.45 percent.

Source: Small Business Administration; note that in previous years the SBA had re-categorized and changed methods of accounting for awards. One example is the inclusion of STTR awards, which though applied for and reported separately, oftentimes are awarded within the same time frame for similar purposes. This tended to inflate previous years' totals. In addition, although technically awarded in any given year, awards to certain recipient companies may not be publicized until later years. The SBA award database is continually updated throughout the year. As a result, data for a given year is generally not complete until April of the following year. For the reasons stated above, values from previous years may have been restated.

AIR SERVICE STATS

AIR SERVICE @ PITTSBURGH INTERNATIONAL AIRPORT

2018 was PIT's busiest year in terms of passenger traffic since 2007, more than a decade ago; finished 2018 with 9.7 million passengers, a 7.5 percent increase over the previous year.

In 2013, the airport finished with its lowest passenger total ever at 7.88 million.

- Passenger traffic has increased for 34 consecutive months.
- Nonstop destinations have increased from 37 in 2014 to 66 today.
- In the past 4½ years, passengers have increased 21 percent.
- Introduced new international service during that time including London Heathrow on British Airways, Frankfurt (Germany) on Condor and Montreal on Air Canada.
- For first time ever, added all-cargo international flight a year and a half ago.
- Increased West Coast flights including Seattle on Alaska Airlines, additions to San Francisco on United, and Salt Lake City on Delta.
- More frequencies have been added to existing key markets such as Boston and Raleigh on Delta, Chicago (multiple) and Newark on United.

COSTS

2019 marks the sixth straight year the Cost Per Enplaned Passenger (CPE) has been lowered, a 31 percent decrease since peaking in 2011 (meaning charges to airlines are lowered)

REAL ESTATE

Broke ground last year on a 195-acre Airport Innovation Campus that will feature office space, research and development laboratories, and industrial manufacturing, with a long-range plan of connecting to the terminal.

COMMERCIAL REAL ESTATE ACTIVITY 2018

By **Tobiah Bilski**, Research Manager, JLL Pittsburgh

Pittsburgh's office market has transformed within the last several years. The reason being, we are starting to experience a lot of the same trends that can be seen in the primary markets. These trends primarily being the urban migration of both tenants and the younger workforce towards the downtown, the optimization of real estate and a rise in technology company demand.

Technology company demand is the main driver of office growth right now. In 2018, the leasing activity of tech companies equated to one-third of the entire leasing activity in the market. A majority of that leasing activity took place in the urban submarkets, mainly in the Fringe. That's why we are experiencing a rush of new development in places like the Strip District and East Liberty. Pittsburgh is early in the cycles of these trends as well. As our tech start-up community continues to breed successful exits, we believe that success will attract more investment, more startups and ultimately, an increased demand for office space.

But as office demand grows, so does the competition for talent. The name of the game right now is recruitment and retention — unemployment is low, population growth is stagnant and job growth is steadily increasing. For a tech company's growth strategies to succeed, they must weaponize their real estate to serve as a recruitment tool instead of simply an expense to be incurred. We have seen examples of this as companies migrate to the urban core to be close to the talent pool. The companies that optimize their real estate now and position themselves correctly within the market, will successfully future-proof their business.

Pittsburgh Office Market

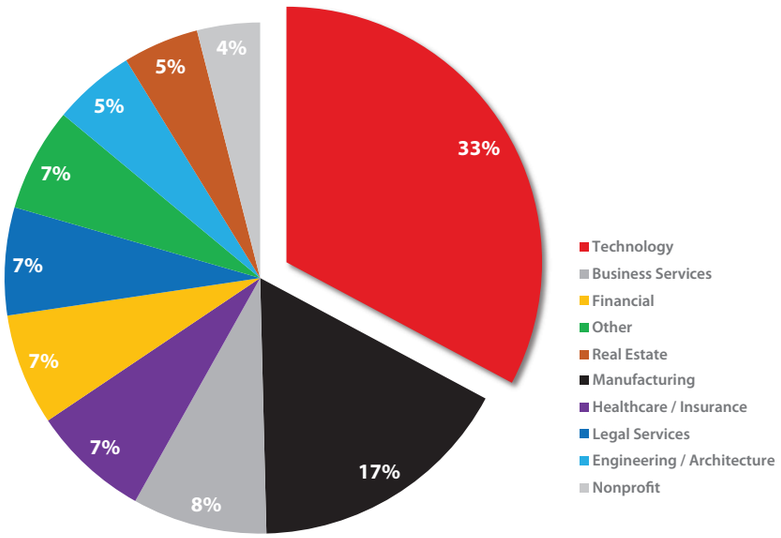
Pittsburgh comprises nine office submarkets. Three submarkets are categorized as "Urban," while the remaining six are considered "Suburban."

Total office inventory is over 52.7M SF, with 23.4M SF in the Suburban submarkets & 29.3M SF in the Urban submarkets. The Pittsburgh office market has experienced steady rent growth for over 10 years, despite vacancy rates peaking in 2017. The rise in vacancy can be attributed to numerous corporations optimizing their real estate.

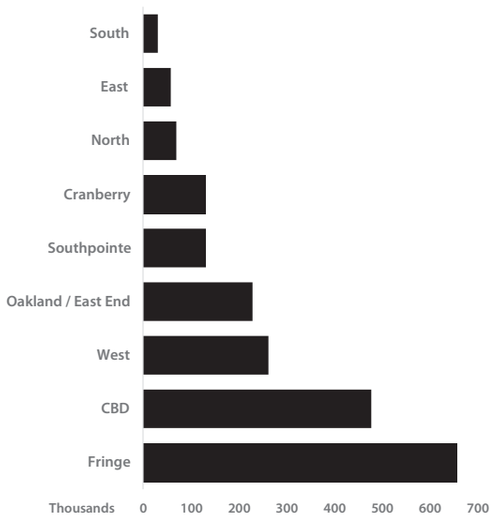
In 2018, total leasing activity was 2.0M SF, with six transactions over 50k SF. Total net absorption for the year was 414k SF or 0.8% of the total inventory. Office leasing activity has been heavily focused around the urban core, due to companies looking to recruit a growing concentration of millennial talent in the CBD, Fringe and Oakland submarkets.

The local technology industry is absorbing space in the urban submarkets as the number of startups and new-to-market tech companies continue to lease space in the urban submarkets.

2018 Leasing Activity by Industry (SF)



2018 Leasing Activity per Submarket (SF)



DEMAND DRIVERS: 3 KEY TRENDS DICTATING THE MARKET

Talent

Pittsburgh's talent hub is driving corporate migration. The population in Pittsburgh's Urban submarkets has a median age of 30.4 years old. The City of Pittsburgh has the fourth-highest concentration of Millennials in the country (% of population 20-35 years old). According to Apartment List, Pittsburgh was ranked as #1 city for young people to live based on job opportunities, affordability and livability.

Migration & Right-Sizing

Since 2015, tenants have increasingly been relocating from suburban offices to the urban submarkets. Since 2015, 16 companies have migrated from the suburbs. From 2018 to present, over 450k SF of existing tenants migrated from the suburbs to the urban submarkets. Since 2015 to present, that number increases to over 700k SF of urban migration.

Technology

Demand is concentrating in the urban submarkets and creating hot neighborhoods. Technology is the fastest growing industry in Pittsburgh. About 33% of the SF leased in 2018 came from technology companies. Since 2015 to present, that number increases to over 750k SF of urban migration.

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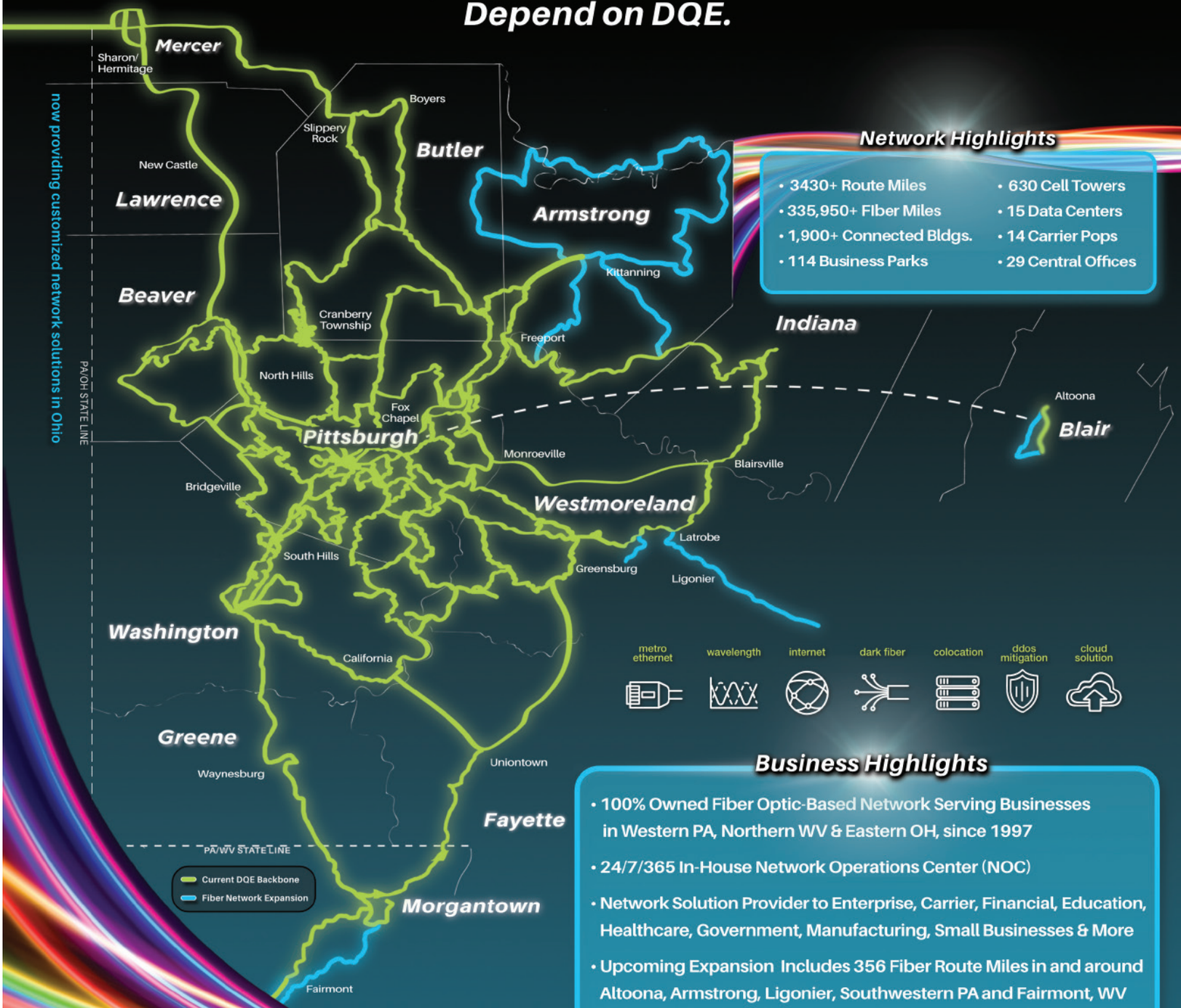

Network Highlights

- 3430+ Route Miles
- 335,950+ Fiber Miles
- 1,900+ Connected Bldgs.
- 114 Business Parks
- 630 Cell Towers
- 15 Data Centers
- 14 Carrier Pops
- 29 Central Offices

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Business Highlights

- 100% Owned Fiber Optic-Based Network Serving Businesses in Western PA, Northern WV & Eastern OH, since 1997
- 24/7/365 In-House Network Operations Center (NOC)
- Network Solution Provider to Enterprise, Carrier, Financial, Education, Healthcare, Government, Manufacturing, Small Businesses & More
- Upcoming Expansion Includes 356 Fiber Route Miles in and around Altoona, Armstrong, Ligonier, Southwestern PA and Fairmont, WV

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VENTURE CAPITAL

Aggregated venture capital activity is another important indicator of regional economic vitality. This section illustrates venture capital investments made in the "Pittsburgh-New Castle-Weirton, PA-OH-WV" Combined Statistical Area (CSA) across five industry verticals. The CSA has 12 counties, including Allegheny County, Armstrong County, Beaver County, Brooke County, Butler County, Fayette County, Hancock County, Indiana County, Jefferson County, Lawrence County, Washington County and Westmoreland County. All data was produced from PwC | CB Insights MoneyTree Report.

TOP DEALS IN 2018

THREAD INTERNATIONAL $22 MILLION

IAM ROBOTICS $20 MILLION

WELLIST $10 MILLION

TCXPRESS $10 MILLION

AGGREGATED VENTURE CAPITAL ACTIVITY

PITTSBURGH CSA 2018

	Businesses	Investors	Rounds	Total Investment
2018	32	57	42	$136 Million
2017	42	65	59	$357 Million

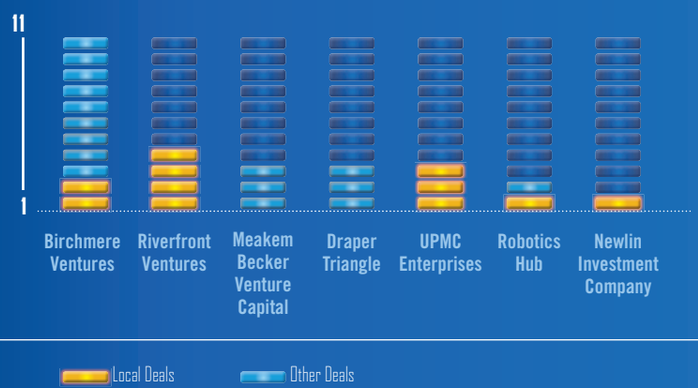
TOP INVESTORS IN PITTSBURGH STARTUPS BY DEALS 2018

Innovation Works (10) Public-Private Partnership
Riverfront Ventures (4) Venture Capital
UPMC Enterprises (3) Corporate Venture Capital
Harbert Venture Partners (2) Venture Capital
Grotech Ventures (2) Venture Capital
Adams Capital Management (2) Venture Capital
Birchmere Ventures (2) Venture Capital
Quake Capital (2) Venture Capital
TechNexus (2) Incubator/Accelerator

TOP INVESTORS IN PITTSBURGH STARTUPS BY SYNDICATED INVESTMENTS 2018

Balderton Capital, Beringea, Forward Partners and H&M CO:LAB ($22M)
KCK-US ($20M)
UPMC Enterprises ($18.5M)
Riverfront Ventures ($12.9M)
.406 Ventures and Summation Health ($10M)
Harbert Venture Partners and Grotech Ventures ($8.2M)

MOST ACTIVE LOCAL VENTURE INVESTORS



The State of the Industry Report's venture capital data is provided by PwC | CB Insights MoneyTree Report

HIGHLIGHTS:

$136M AGGREGATE INVESTMENTS FOR 2018

- 2018 investments dropped 62%, driven primarily by the absence of large rounds
- Top 3 Deals raised $62M ($131M less than 2017's Top 3 Deals raised)
- 32 businesses raised 42 rounds from 57 investors
- Compared to 2017, there were 24% fewer startups raising smaller rounds on average ($3.6M vs $6.4M average deal size in 2017)
- Internet firms raised the most money ($44M) closely followed by Industrial companies ($30M)

57 FIRMS INVESTED IN PITTSBURGH STARTUPS, AND SOME REALLY STOOD OUT

- Local investor Innovation Works participated in the most deals (10), followed by Riverfront Ventures (4)
- Four non-local investors, however, participated in the year's largest deal - Thread International ($22 Million, Series B)
- UPMC Enterprises, third most active investor, participated in three local health care tech deals totaling $18.5M of investments

WHICH VCs RAISED FUNDS IN THE LAST 3 YEARS?

- Birchmere Ventures raised ($26M in 2015), iNetworks ($24M in 2016) and Robotics Hub ($5M across 2016-17)

OF INTEREST:

ROUNDING OUT INVESTMENTS ACTIVITY FOR 2018

- Voci Technologies dominated the Software (non internet/mobile) Sector with an $8M investment
- Aspinity represented the Electronics Sector with a $3M investment

HEALTHCARE SECTOR

INDUSTRIES REPRESENTED:

- Biotechnology
- Drug Discovery
- Medical Devices & Equipment
- Stealth Mode

	Businesses	Investors	Rounds	Total Investment
2018	5	6	5	$18 Million
2017	8	27	11	$147 Million

TOP COMPANIES BY INVESTMENT

TCXpress ($10M)
Globin Solutions ($5M)
Cernostics ($2.5M)
Carmell Therapeutics ($.44M)
Sharp Edge Labs

TOP INVESTORS BY DEALS

UPMC Enterprises (2)
Tus Holdings (1)
Illumina Ventures (1)
Pittsburgh Life Sciences Greenhouse (1)
vSpring Capital (1)
LifeX Ventures (1)

CONSUMER PRODUCTS & SERVICES SECTOR

INDUSTRIES REPRESENTED:

- Clothing & Accessories
- Industry

	Businesses	Investors	Rounds	Total Investment
2018	1	4	1	$22 Million
2017	1	1	1	$2 Million

TOP COMPANIES BY INVESTMENT

Thread International ($22M)

TOP INVESTORS BY DEALS

Balderton Capital (1)
Beringea (1)
Forward Partners (1)
H&M CO:LAB (1)

INTERNET SECTOR

INDUSTRIES REPRESENTED:

- eCommerce
- Internet Software & Services

	Businesses	Investors	Rounds	Total Investment
2018	11	25	17	$44 Million
2017	15	25	22	$66 Million

TOP COMPANIES BY INVESTMENT

Wellist ($10M)
iraLogix ($7.98M)
Niche.com ($6.6M)

TOP INVESTORS BY DEALS

Innovation Works (5)
Birchmere Ventures (2)
Adams Capital (2)
Riverfront Ventures (3)

INDUSTRIAL SECTOR

INDUSTRIES REPRESENTED:

- Aerospace and Defense
- Basic Materials
- Machinery and Equipment

	Businesses	Investors	Rounds	Total Investment
2018	5	9	6	$30 Million
2017	4	5	5	$10 Million

TOP COMPANIES BY INVESTMENT

IAM Robotics ($20M)
Gecko Robotics ($7M)
nanoGriptech ($1.8M)
LiquidX Printed Metals ($1.4M)

TOP INVESTORS BY DEALS

Innovation Works (2)
KCK-US (1)
Founders Fund (1)
Mark Cuban (1)

MOBILE & TELECOMMUNICATIONS SECTOR

INDUSTRIES REPRESENTED:

- Mobile Commerce
- Mobile Software and Services

	Businesses	Investors	Rounds	Total Investment
2018	3	8	5	$10 Million
2017	7	11	10	$14 Million

TOP COMPANIES BY INVESTMENT

Anglr Labs ($5.8M)
RoadBotics ($4M)

TOP INVESTORS BY DEALS

Innovation Works (2)
Hyperplane Venture Capital (1)
BlueTree Allied Angels (1)

NOTES ON METHODOLOGY

PwC (pwc.com/moneytree.com) and CB Insights (cbinsights.com) encourage you to review the methodology and definitions employed to better understand the numbers presented in this report. If you have any questions about the definitions or methodological principles used, we encourage you to reach out to CB Insights directly. Additionally, if you feel your firm has been underrepresented, please send an email to info@cbinsights.com and we can work together to ensure your firm's investment data is up-to-date. Rankings, e.g., top states and top sectors, are done by quarterly deal activity (that is, deal count for the given quarter).

WHAT IS INCLUDED:

- Equity financings into emerging companies. Fundings must be to VC-backed companies, which are defined as companies that have received funding at any point from either: venture capital firms, corporate venture arms, or super angel investors.
- Fundings of private companies only. Funding rounds raised by public companies of any kind on any exchange (including Pink Sheets) are excluded from our numbers, even if they received investment by a venture firm(s).
- Only includes the investment made in the quarter for tranched investments. If a company does a second closing of its Series B round for $5M and previously had closed $2M in a prior quarter, only the $5M is reflected in our results.
- Round numbers reflect what has closed – not what is intended. If a company indicates the closing of $5M out of a desired raise of $15M, our numbers reflect only the amount which has closed.
- Only verifiable fundings are included. Fundings are verified via (1) various federal and state regulatory filings; (2) direct confirmation with firm or investor; (3) press release; or (4) credible media sources.
- Equity fundings to joint ventures and spinoffs/spinouts are included, given that they meet the VC-backed criteria.
- Geography note: Israel funding figures are classified in Asia.

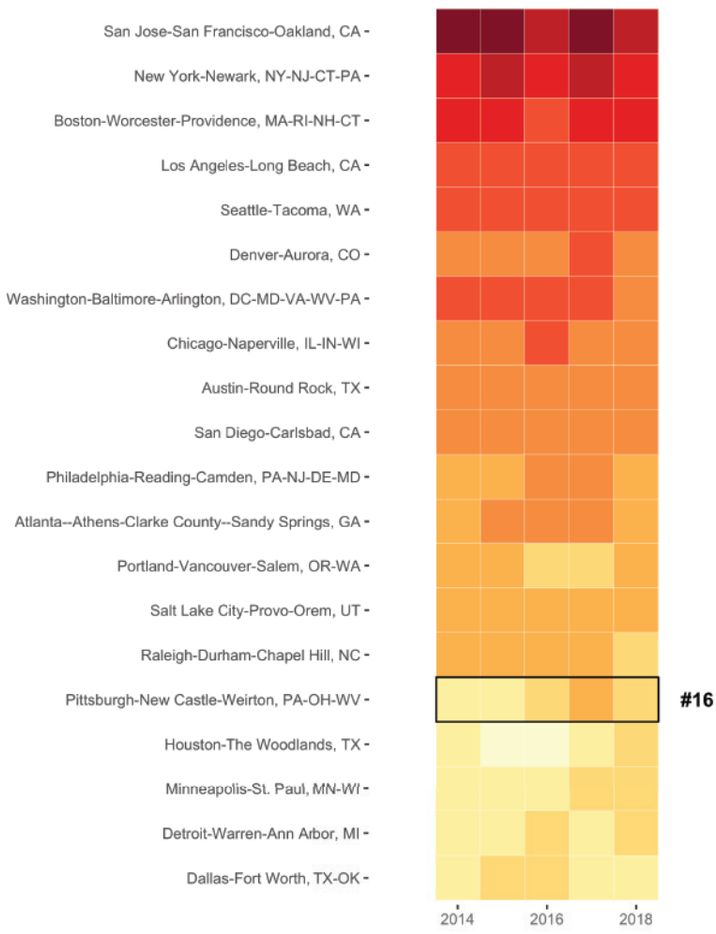
WHAT IS EXCLUDED:

- No contingent funding. If a company receives a commitment for $20M subject to hitting certain milestones but first gets $8M, only the $8M is included in our data.
- No business development / R&D arrangements whether transferable into equity now, later or never. If a company signs a $300M R&D partnership with a larger corporation, this is not equity financing nor is it from venture capital firms. As a result, it is not included.
- No buyouts, consolidations or recapitalizations. All three of these transaction types are commonly employed by private equity firms and are tracked by CB Insights. However, they are excluded for the purposes of this report.
- No private placements. These investments, also known as PIPEs (Private Investment in Public Equities), are not included even if made by a venture capital firm(s).
- No debt/loans of any kind (except convertible notes). Venture debt or any kind of debt/loan issued to emerging, startup companies, even if included as an additional part of an equity financing, is not included. If a company receives $3M with $2M from venture investors and $1M in debt, only the $2M is included in these statistics.
- No non-equity government funding. Grants or loans by the federal government, state agencies, or public-private partnerships to emerging, start-up companies are not included.
- No fundings to subsidiaries of a larger parent corporation.
- PwC refers to the US member firm or one of its subsidiaries or affiliates, and may sometimes refer to the PwC network. Each member firm is a separate legal entity. Please see www.pwc.com/structure for further details.

All data was produced from PwC / CB Insights MoneyTree™ Report and is current as of 4/9/19.

HOW DOES PITTSBURGH STACK UP?

DEAL ACTIVITY HEATMAP



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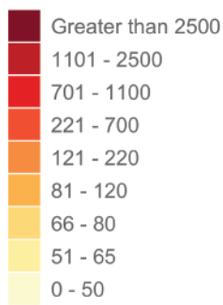
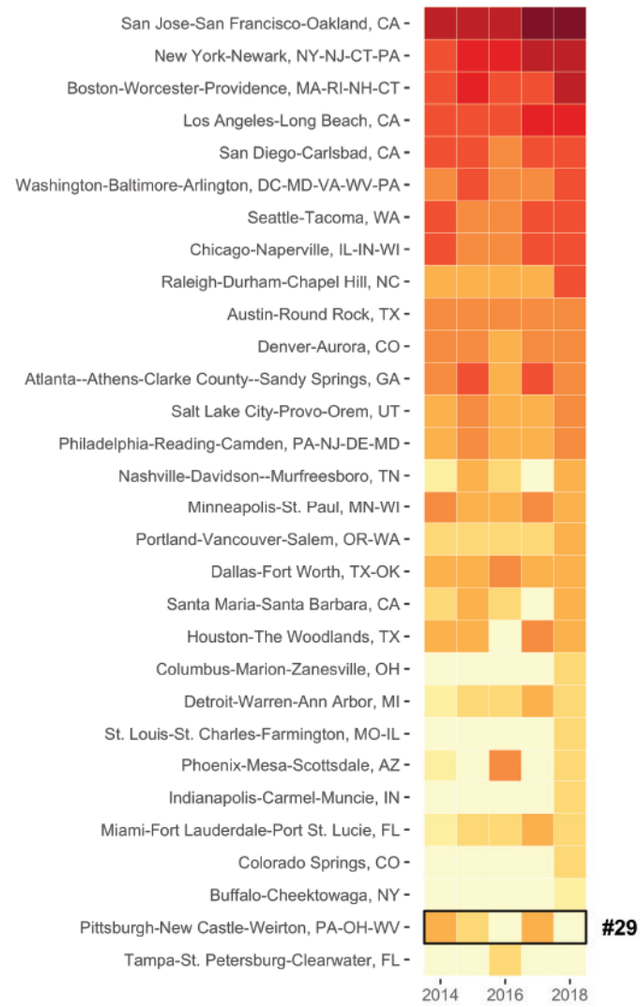
DEAL ACTIVITY IN PITTSBURGH RANKED 16TH

- Pittsburgh beats Houston & Minneapolis… coming in just behind Research Triangle Park, in 2018 deal activity
- 196 metro areas with VC-backed investments were compared
- Pittsburgh ranked #20 by population during the 2010 U.S. Census (i.e., Combined Statistical Areas)



INVESTMENT HEATMAP



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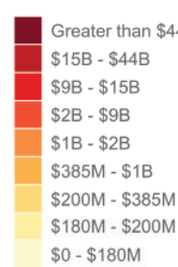
INVESTMENTS INTO PITTSBURGH RANKED 29TH

- Pittsburgh beat Tampa-St. Petersburg-Clearwater in investments over the last 5 years
- 180 metro areas with VC-backed investments were compared
- Pittsburgh ranked #20 by population during the 2010 U.S. Census (i.e., Combined Statistical Areas)



All data was produced from PwC / CB Insights MoneyTree™ Report

Allegheny County Parks Foundation

ALLEGHENY COUNTY
ALWAYS INSPIRING

ALLEGHENY COUNTY'S 9 PARKS GET **22 million visits every year***

Why do people love their PARKS?

92% say they conserve the environment

88% say the parks improve their physical health

87% say the natural environment and serenity of the parks lower stress and improve mental health

91% **say they're FUN,** with walking, hiking, biking, playgrounds, jogging and dog parks cited as the most popular activities.

ALLEGHENY COUNTY PARKS TOTAL

12,000 acres

76% are covered with trees**

Allegheny County Parks offer year-round recreation, with **279** facilities to rent, **2** golf courses, **4** pools, **2** skating rinks, **1** ski slope, **4** lakes, **23** creeks and streams, and more than **100** miles of trails.

* Statistics based on 2016 survey conducted by Allegheny County Parks Foundation, with funding from Colcom Foundation and Richard King Mellon Foundation.

** Tree Pittsburgh Urban Tree Survey

Thanks to Allegheny County Parks and County Executive Rich Fitzgerald for their cooperation and support.

www.acparksfoundation.org | 724.327.7627

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PwC'S ESSENTIAL EIGHT

YOUR GUIDE TO THE EMERGING TECHNOLOGIES REVOLUTIONIZING BUSINESS NOW

By **Justin Kaufman,** Pittsburgh Managing Partner and Midwest Advisory Leader and
Kris Kersey, Blockchain Director Lead, Emerging Technologies and New Services

The new tech future is here! Technology is evolving at breakneck speed and is already defining what's next — for your company, competitors and industry. Business leaders understand this: 76% of CEOs in our annual survey are worried about the speed of tech change. And 64% acknowledge that changes in the technology used to run their businesses will be disruptive over the next five years. Emerging technology should be a key part of every company's corporate strategy. So why are so many hesitant to take action?

To help companies focus their emerging tech efforts, we analyzed the business impact and commercial viability of more than 250 emerging technologies to zero in on the "Essential Eight." These are the core technologies that matter most for business, across every industry, over the next three to five years. The Essential Eight are the technology building blocks that we believe every organization must consider. While each company's strategy for how to best exploit — and combine — them will vary, these technologies will have a profound global impact on business, employees and customers.

Learn more at
pwc.com/essentialeight

The Essential Eight technologies that matter most for business

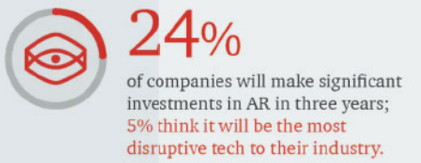
Artificial Intelligence

Software algorithms are automating complex decision-making tasks to mimic human thought processes and senses. Artificial intelligence (AI) is not a monolithic technology. A subset of AI, machine learning, focuses on the development of computer programs that can teach themselves to learn, understand, reason, plan and act when blasted with data. Machine learning carries enormous potential for the creation of meaningful products and services — for example, hospitals using a library of scanned images to quickly and accurately detect and diagnose cancer; insurance companies digitally and automatically recognizing and assessing car damage; or security companies trading clunky typed passwords for voice recognition.

Source: PwC Global Artificial Intelligence Study, 2017

Augmented reality

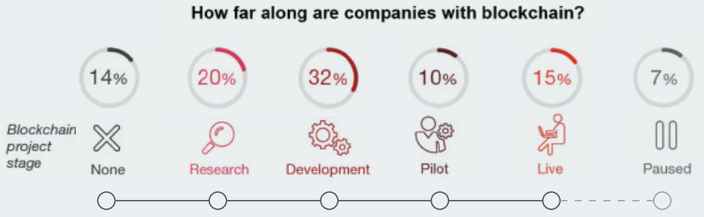
Augmented reality (AR) is a visual or audio "overlay" on the physical world that uses contextualized digital information to augment the user's real-world view. AR-enabled smart glasses help warehouse workers fulfill orders with precision, airline manufacturers assemble planes, and electrical workers make repairs. We're currently seeing mainstream gaming examples of AR that span age demographics. The power of bringing information to the point of action in a seamless, unobtrusive manner is undeniable. This blending of the physical and virtual worlds is cracking open a new realm for businesses across the board to explore.



Source: PwC 2017 Global Digital IQ Survey

Blockchain

A blockchain is a distributed digital database or, more broadly, a digital ledger that uses software algorithms to record and confirm transactions with reliability and anonymity. The record of events is shared between many parties and information once entered cannot be altered. Blockchain has the potential to usher in an era of autonomous digital commerce.



Note: Numbers are rounded (sum does not equal 100 due to rounding). Source: PwC Global Blockchain Survey, 2018

Drones

Depending on their design, drones vary greatly in their capacity. Some drones need wide spaces to take off, while quadcopters can squeeze into a column of space. Some drones are water based; others can operate and navigate autonomously (via remote control) or fully autonomously (via onboard computers). Companies are using drones for wide-ranging reasons, including surveillance, survey, sport, cinematography and delivery.

5%

of businesses are making significant investments in drones today; 14% will in the next three years.

Source: PwC 2017 Global Digital IQ Survey

Internet of things

The Internet of things (IoT) is a network of physical objects — devices, vehicles, appliances — embedded with sensors, software, network connectivity, and computing capability enabling them to collect, exchange and act on data, usually without human intervention. The industrial IoT (IIoT) refers to its use in the manufacturing and industrial sectors, aka Industry 4.0. IIoT augments people, places, processes and products with sensors to capture and analyze information across a value chain, advancing the goals of the organization.

73% of companies are making IoT investments today;

47% say it will be the most important tech for cutting costs.

Source: PwC 2017 Global Digital IQ Survey

Robotics

Robots are machines with enhanced sensing, control, and intelligence used to automate, augment, or assist human activities. The robot market, which has grown for industrial applications, is poised for growth in a broad range of services applications. These applications are transforming manufacturing and non-manufacturing operations with new capabilities that address the challenges of working in changing, uncertain, and uncontrolled environments, such as alongside humans without being a danger to them.

31% of businesses will make significant investments in robotics in three years;

13% say it will be the most disruptive tech to their business model within the next five years.

Source: PwC 2017 Global Digital IQ Survey

Virtual reality

Virtual reality (VR) abolishes logistical limitations and makes anything possible. In a computer-generated simulation of a three-dimensional image or environment, viewers can use special equipment to interact with the simulation in realistic ways. The gaming and entertainment industries are obvious proving grounds for VR. However, VR has the potential to transform many other industries as well, especially in the realm of experiential training where workers can be put into hazardous, difficult or cost-prohibitive situations without the intense risks associated with these activities in the real world.

7% of companies are making significant investments in VR today; 15% in three years.

Source: PwC 2017 Global Digital IQ Survey

3-D printing

3-D printing creates three-dimensional objects based on digital models by layering or "printing" successive layers of materials. 3-D printing relies on innovative "inks," including plastic, metal, and, more recently, glass and wood. 3-D printing has the potential to turn every large enterprise, small business and living room into a factory.

Top industries making 3-D printing investments over next three years

35% of automotive companies

29% of industrial product companies

29% of healthcare companies

Source: PwC 2017 Global Digital IQ Survey

What's next for the Essential Eight?

Like all technology, our Essential Eight continue to mature and be used in new ways. And the most important trend? Combining individual technologies to yield powerful applications that are greater than the sum of their parts. For example, using IoT sensors to automatically collect data about raw materials moving through a supply chain, then recording that data in a blockchain to create a singular and unchangeable record everyone in the supply network can see. Or using video captured from a drone flying over that same raw material and using AI to not only recognize the material, but also determine how much had been used since the last time the images were analyzed.

FIBER OPTIC NETWORKS POWER UP THE PITTSBURGH REGION'S TECH ECOSYSTEM

The usual telecom company standard is to offer one-size-fits-all network services through out-of-date copper networks. DQE Communications offers custom data, internet and network solutions to businesses of every size and industry, all on a 100% fiber optic network.

DQE's rapidly growing network currently stretches more than 3,400 miles in southwestern Pennsylvania, northern WV & eastern OH. This network includes connectivity to 1,700 on-net buildings, 600+ cell towers, 15 data centers and 114 business parks.

DQE Communications' President and CEO Jim Morozzi credits the company's success to what the team calls the "DQE Difference." This phrase refers to what sets DQE apart from other service providers. "We provide local expertise, with 24 x 7 x 365 support. Our fiber optic network architecture is 100% built, owned and maintained by DQE. We personally design and install each customer's infrastructure, and we're going to be the ones who manage it. Our self-healing, fiber optic, ring-based architecture offers superior redundancy with the highest committed speeds," stated Morozzi.

Locally, DQE supports technology and business growth in the communities it serves. Morozzi notes that "Our customer base is full of groundbreaking and forward-thinking clientele, and as they innovate their services, DQE advances with them. Our product portfolio and new services are driven by the needs of our customers. The businesses and industries we serve need a strong data/IT infrastructure support system as the foundation of their business, which DQE provides and enables our customers to succeed."

Jim Morozzi
President and CEO, DQE Communications

When asked what he sees in Pittsburgh's future for technology and innovation,

"Our self-healing, fiber optic, ring-based architecture offers superior redundancy with the highest committed speeds."

Morozzi foresees enduring growth as the region continues to add tech startups. As technology advances and grows, more opportunity exists.

"I expect DQE to be a foundational part of the success and growth of technology and innovation by continuing to be the reliable, secure data service provider for businesses in every industry – including AI, robotics, medicine and so many other categories that have seen tremendous growth recently in this area. It's an exciting time."

Morozzi's career has encompassed both telecommunications and electric utility industries, and prior to joining DQE, he was President and CEO with D&E Communications. He holds a Bachelor of Science in Electrical Engineering, as well as a Master of Business Administration from Drexel University. He also completed the Columbia University Senior Executive Program and serves on the board of directors at Murray Securus in Lancaster, Pa.

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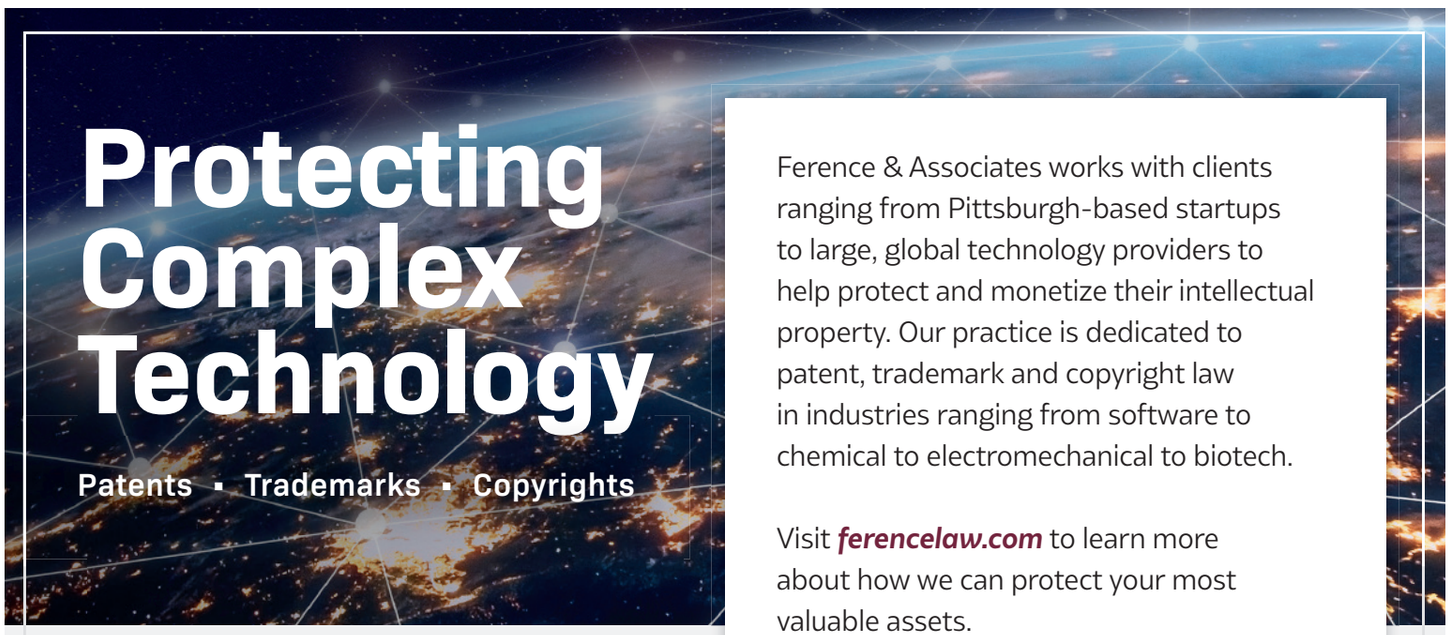

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ExOne SETS THE STANDARDS IN 3D PRINTING

By **Elizabeth Byrnes**

The ExOne Company (ExOne), founded in 2005 as a spin-off of Extrude Hone Corporation, provides 3D printing machines, 3D printed products and related services to industrial customers in multiple segments, including automotive, aerospace, industrial equipment, research and development, education and energy.

3D printing (3DP) is a manufacturing process that builds layers to create a three-dimensional solid object from a digital model, able to produce parts with geometric features that cannot be accomplished by other manufacturing processes. Based on a patented 3DP process developed at MIT, ExOne builds functional 3D objects from the bottom up, one layer at a time with durable, industrial-strength materials ranging from metals to silica sand and ceramics, all used in revolutionary ways.

The ExOne process uses binder jetting technology, an additive manufacturing process in which a liquid binding agent is selectively deposited to join powder particles. Right now, metals are the hottest area in the additive manufacturing industry. As a company started in western Pennsylvania, ExOne is perfectly situated in a region that not only has a significant history of metal, but also has all of the great elements and resources for powder metallurgy.

"ExOne is the leader in binder jet printing with almost 20 years of experience. Industry now recognizes that binder jet printing is the key technology for scaling 3D printing from prototype applications to real volume production. This will drive an explosion of new applications for our customers and for ExOne," says John Hartner, Chief Operating Officer.

The Steel City has a legacy with metals which perfectly aligns with ExOne's accelerated growth in additive manufacturing. ExOne has the opportunity to leverage the ecosystem in the region to power their growth even further in the industry.

"The Pittsburgh and the Ohio Valley area played a major role in the last industrial revolution, sometimes called the Third Industrial Revolution. Now with the digitization of manufacturing leading to the Fourth Industrial Revolution, I see the same opportunity for this region to play a leadership role."

ExOne is well positioned for ongoing advancement in the industry. It has all of the environmental benefits of the region, as well as all of the fantastic universities in the surrounding areas – CMU, Pitt, Youngstown State University, to name a few. Also, in nearby Youngstown, Ohio is America Makes, the national center for additive manufacturing. The budding additive manufacturing industry is on the rise and ExOne is using all of its local resources to grow its unique technologies.

"We have a great team here in this region

and globally. Every day we are working with leading customers to solve their toughest manufacturing problems and create new products and business opportunities for them. ExOne helps customers thrive in this digital industrial revolution."

ExOne has grown from a handful of engineers to a worldwide team with operation and support facilities in Germany, the United States and Japan. It is the global leader in 3D printing systems and is the optimal partner for any industrial manufacturer who is transitioning their manufacturing business to the digital age.

"Every day we are working with leading customers to solve their toughest manufacturing problems and create new products and business opportunities for them. "

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LENDINGHOME DISRUPTS THE MORTGAGE INDUSTRY, CHOOSES PITTSBURGH TO GROW

By **Elizabeth Byrnes**

Six years ago, James Herbert was going through the refinancing process. It took him almost five months. His frustrations came up in conversation with his entrepreneur friend, Matt Humphrey, and together they realized that the mortgage industry was in the perfect position to be disrupted. So, LendingHome was started.

Founded in 2013, The San Francisco-based company created a new marketplace platform that reimagined mortgage lending from the ground up, with technology at the core.

LendingHome combines innovative technology with an experienced team to create a seamless, transparent process for borrowers and investors. Speed and efficiency were the driving factors when LendingHome built its own loan origination system from scratch.

Through LendingHome's 100% online platform, they offer bridge loans designed specifically for residential property investors looking to finance their next fix and flip. LendingHome offers a fast close and reliable access to capital at competitive rates. Their loans feature competitive terms and a transparent process with dedicated help every step of the way.

LendingHome is the subject matter expert in bridge loans, currently offering them in 26 states. Average lending companies offer bridge loans in only five or six.

LendingHome has funded more than $3.5 billion in mortgage loans for over 15,000 projects to become the largest and fastest-growing fix-and-flip lender. Today LendingHome partners with thousands of house flippers across the United States, providing them with reliable financing and expert advice.

LendingHome has more than 300 employees between San Francisco and Pittsburgh

LendingHome's Pittsburgh team at its Nova Place offices.

"Pittsburgh has deep roots both in technology and finance; these make Pittsburgh the perfect place for LendingHome to build a disruptive mortgage platform."

and has raised more than $100 million in equity financing. This year, LendingHome centralized its mortgage operations department in Pittsburgh, doubling the number of employees in the area.

"Pittsburgh has deep roots both in technology and finance; these make Pittsburgh the perfect place for LendingHome to build a disruptive mortgage platform," said Pat Stephenson, Director of Engineering.

Because of this growth, lendingHome recently moved from its 5,000 ft^2 office space into a new 20,000 ft^2 space in Nova Tower 2. It hosted a grand opening of their new space in May, announcing to the Pittsburgh region that "We are here! And we're here to stay!"

"Innovation is at the forefront of everything we do and the Steel City is the perfect location for LendingHome to build on its past success and become the titan of our industry," said Patrick McLuckie, Vice President of Mortgage Operations.

CEO Matt Humphrey is a proud Pittsburgh native and is thrilled to bring jobs to the area. LendingHome offers appealing jobs to all the fresh graduates in the area, encouraging them to stay in the city. They are also hoping to entice those from around the country who don't have roots to come see what Pittsburgh has to offer.

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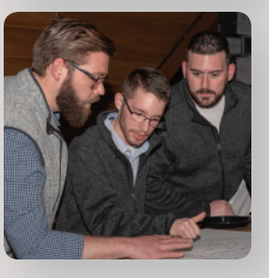
25 YEARS STRONG!

PASSION FOR ITS PEOPLE AND CULTURE UNDERSCORES THE SUCCESS OF IQ INC.

By **Tim Hayes**



It is easy to pick up on the passion that Barbara VanKirk, CEO and President of IQ Inc., exudes when she discusses the past, present and future of the company that she founded in 1994. "Nothing can ever replace one-to-one human contact. Talk more, text less – that's a personal goal this year, to be more mindful of whether my words and actions are projecting the right messages. It's really about refining all the pieces that have been put in place over the last 25 years." IQ Inc., which celebrates its silver anniversary in business this year, continues to emphasize people and culture, over technical abilities.

IQ Inc. works with clients on end-to-end software development projects, from full stack development to systems integration, and from testing to certification support. This work is performed at its state-of-the-art development facility or by embedding IQ Inc. consultants on-site to work with a client's staff.

VanKirk and her team pay particular attention to the communications required to ensure that the entire organization remains informed about risks, upsides and impact of the scope and feature changes that can occur. In order to achieve key software development objectives, IQ Inc. rigorously documents progress and continuously communicates with clients as their work progresses.

In a field where technical expertise may seem to be the focal point of performance and achievement, IQ Inc. takes another view. Culture is everything. The IQ culture places people skills above technical skills. The belief behind this approach is nothing more, and nothing less, than this – when you can cooperate, respect, collaborate, speak honestly and trust each other, the business results will naturally follow.

"Over the next 25 years we want to continue to mentor, encourage, and lead our team forward," said VanKirk. "We don't see ourselves as either a contractor or consultant, but a partner with our clients, based on frequent and open communication. It's about changing the future, providing expertise to our clients by staying ahead of technology, and setting the path. My success is when the answers don't come from me but from the individuals here."

The world of technology and software applications has changed dramatically in a quarter-century, but from its Monroeville headquarters, IQ has not only kept pace with that rate of change, but has remained ahead of it in many ways. As the next chapter opens for the firm, VanKirk expresses a firmly held faith in the team she has assembled – from our most seasoned employee, who has been an IQ consultant for 22 years, to the newly

"We don't see ourselves as either a contractor or consultant, but a partner with our clients, based on frequent and open communication."

graduating, joining our team this summer.

"We hear a lot about millennials, and how they want to make the world a better place to live," she noted. "They care about the future, the environment. We need to embrace that, set that path for them creatively to follow. We can learn from them how to work better at cross-generational levels, how to better engage everyone by drawing on the millennials' preference of collaboration. The world is the playground of this generation. If the opportunity for impact is there, they should embrace it and we should do it together."

Over the past few years, IQ Inc. has doubled in size as measured by the number of employees, which totals 80 currently. It also achieved a doubling of its revenues, serving anywhere from 12 to 25 client projects at any one time. Those clients range from startups to major corporations, based both in the U.S. and internationally. But VanKirk said the secret to IQ's success has never been about its size. Instead, it has always centered around the impact the company makes – both internally as its team expands, and on its clients and the communities it serves.

"IQ began with the notion of trying to serve companies who focused on engineered products," she concluded. "Security, robotics, artificial intelligence – all of these are happening right here in Pittsburgh. That means the same mission exists for us to make a positive impact. I see IQ 25 years from now as being just as ready to adapt and grow, and making an impact, as it was when I started it in 1994."

IQ Inc.

CONTACT:

724-327-3441

iq-inc.com

GIVING PEOPLE A VOICE:
TOBII DYNAVOX GROWS IN PITTSBURGH CREATING COMMUNICATION DEVICES

By **Tim Hayes**

Communicating seems like such a simple, take-it-for-granted part of life. But for those whose physical, mental or emotional conditions prevent or impede the ability to communicate, the ramifications can be devastating.

Fortunately, Pittsburgh has served as the home base of an innovative company for decades that has dedicated itself to bridging those gaps – and today the technological tools available are truly breathtaking.

Tobii DynaVox, based on the South Side, employs a team of enthusiasts who are passionate about helping people with special needs. Their goal is to make a real difference by creating solutions that help people communicate with their environment, thereby living a richer and more independent life. And even though the company had its genesis here, its products and services enhance people's lives worldwide.

DynaVox formed in 1983 as Sentient Systems. Collaborating with Carnegie Mellon University and the Children's Institute of Pittsburgh, a device called the Eye Typer was created for a woman with cerebral palsy who could not speak. Tobii (leader in eye-gaze devices) and DynaVox (leader in touch device) came together as one company in 2014.

Solutions offered include software and practical tools that can be used on iPads and other tablets, laptops, mounted on wheelchairs and assistive devices. Some serve as the "voice" of the user, while others interpret communications from outside. Certain technologies enable users to communicate by touching a screen, while some operate solely by tracking eye movement. The array of options is ever-expanding and is designed to help users overcome as many barriers to easy and open communication as possible.

On the software side, Tobii DynaVox has developed communication software and language systems based on extensive research and knowledge to support every individual throughout his or her communication journey in every part of life, from speaking first words to becoming literate and independent. Tobii DynaVox products and services not only benefit users, but also the people around them – parents, siblings, grandparents and caregivers as well as others encountered in everyday life. The goal remains helping users to unleash their inner strength and potential, giving them

"It's really about refining all the pieces that have been put in place over the last 25 years."

the autonomy, power, and freedom to decide what to say and do on their own terms.

The company states very clearly that it does not create simple "apps," and for one very good reason. Apps, for all of their appeal and apparent ease of operation, often lead the unique population of Tobii DynaVox users to become static in their communication. Instead, the company offers communication solutions that every individual can grow and develop with throughout his or her life.

Tobii DynaVox, part of the Sweden-based Tobii Group, has emerged as the leading provider of touch- and eye-tracking-based assistive technology hardware and software for those with communication and mobility challenges. Thousands of individuals with disabilities such as aphasia, autism, cerebral palsy, ALS, muscular dystrophy, Rett syndrome and spinal cord injury have benefited from its offerings.

Other companies within the Tobii Group share our extensive knowledge and experience in eye tracking and gaze interaction with Tobii DynaVox, helping to spur additional innovation and development of new applications.

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DEVELOPING ADVANCED VISUALIZATION SOLUTIONS TO MAKE THE WORLD A SAFER PLACE

By Chris Mueller, Cosmitto Digital

ChemImage is a Pittsburgh-based molecular chemical imaging company striving to address important, unmet needs in a variety of market segments, including health care, corrections, law enforcement and defense. CI is bringing to each of these markets a common technology platform built around proprietary electro-optic filters, empowered by artificial intelligence algorithms, and software. Molecular chemical imaging, in essence, is the use of light to identify objects or materials that normally aren't visible to the naked eye by harnessing the spectral signature of the object of interest. So, with its breakthrough imaging technology, ChemImage collects that information, analyzes it, and then provides the results to physicians and safety and security professionals in a concise, clear and accessible fashion unlike ever before.

It was more than 25 years ago when ChemImage Founder and Chief Technology Officer, Patrick Treado, Ph.D. first began pursuing ChemImage's revolutionary mission. The research problems Treado was trying to solve were difficult. "We were trying to use light to measure disease, but none of the ecosystem to make that practical existed at that time," he said. "The idea was real. It should've been possible to measure disease states, but all of the tools necessary to make it work in a way that was helpful to clinicians didn't exist."

ChemImage's efforts to develop an innovative spectroscopy platform have turned Treado's research mission into vision. The 115-person company, as a whole, holds more than 190 patents for applications in detecting explosives, chemicals and narcotics, as well as advanced visualization and cancer detection during surgeries and diagnostic procedures. Treado expects to receive FDA approval for surgical visualization tools in <3 years, which will be an important milestone for the maturation of ChemImage and its Life Sciences products. Another innovation, CardioVere, a tool to measure and quantify edema in heart failure patients is currently in early stage human testing and moving with pace towards clinical and commercial maturation.

So now, after 25 years developing advanced visualization solutions to solve some of the world's most difficult problems, ChemImage can finally let there be light.

"We developed tools to solve very complicated problems, but if you can solve those problems, you can harness the power of light to make measurements that allow clinicians to understand and manage disease," said Treado. "Our other applications of the technology are good vehicles to de-risk technology so we can solve important health roadblocks."

For example, let's say a clinician is treating a patient for colorectal cancer. In order to

surgically remove the cancer, that surgeon must identify and differentiate the tumor from other tissue structures, extract the cancerous cells and then precisely stitch the tissue back together to maintain its viability. The process is meticulous in nature with the potential to go awry.

ChemImage's technology alleviates some of those immense challenges by helping surgeons to identify veins, nerves, arteries, tumor location and more. Most importantly, molecular imaging removes the need to rely on contrast agents or dyes for visualization, which can be harmful to the human body, make surgery more complicated and higher in cost.

"Advanced visualization for endoscopy is a pretty significant part of the portfolio," said Treado. "But, we're also very much involved in heart health monitoring. Specifically, CardioVere is an optical device to quantitatively and non-invasively assess the level of edema for congestive heart failure patients by measuring reflectance of water molecules just below the skin."

The impact of ChemImage's molecular imaging extends beyond the medical field, though. It is also utilized as a mail screening method in correctional facilities to detect the presence of opioids in otherwise hard-to-detect environments. Thirdly, it can provide military, law enforcement and security personnel with the capability to detect explosives, chemicals and narcotics in a variety of environments. "ChemImage is about making the world a healthier and safer place," said Treado.

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THE RIGHT PICK

IAM ROBOTICS LEADS THE WAY IN MATERIAL HANDLING SOLUTIONS

IAM Robotics is a Pittsburgh-based commercial robotics corporation developing into a leader of flexible autonomous robotic material handling solutions for e-commerce order fulfillment in material handling, logistics and manufacturing. Through its Swift Product Suite, the company is revolutionizing mobile manipulation robotics to make flexible automation a reality.

How? These mobile robots are the first of their kind to hold the capability to locate items on warehouse shelves, select them with robotic arm technology and then transport them throughout the warehouse in order to be shipped out to consumers.

"We as consumers spend about 40 billion hours a year shopping for goods in retail stores," said IAM Robotics CEO Joel Reed. "But as we begin staying home more often and buying those items through e-commerce portals, somebody has to do that shopping for us. There aren't enough people in the labor force today to complete all that work.

"We need automation, and more specifically, we now have the opportunity to use mobile robots to accomplish it."

The robots can individually select items from shelves using advanced perception algorithms. Their ability to sense the world around them allows for e-commerce fulfillment. The Swift Solution combines technology and autonomous robots to act as the vision, conductor and workhorse of the entire operation.

First is Flash, a high-performance product dimensioner and photo booth that can record barcodes, 3D dimensions, weight and high-resolution product images in less than a second. Next comes SwiftLink, a robust software interface to integrate existing warehouse management systems into the process. It can issue commands, monitor robot statuses, track both productivity and cost-effective analytics, and allow for 24/7 notifications to any mobile device.

And finally, rounding out the operation is Swift, which will physically go and retrieve the items through communication with SwiftLink. It can work up to 10 hours without interruption to increase pack and ship operations into a competitive advantage over other companies. Additionally, Swift can be paired with Bolt, a transport robot, whose main benefit is to further improve the throughput and ROI of the Swift Solution by exchanging totes with Swift, delivering the full tote to the next process in the fulfillment cycle such as packing and shipping. By leveraging Bolt for transport, Swift remains focused on picking.

The best part of it all is that IAM Robotics, headquartered in Sewickley, is completely Pittsburgh-made. Co-founders Tom Galluzzo and Vladamir Altman are both highly affiliated with Carnegie Mellon University's world-renowned Robotics Engineering Center, and have utilized the city's thriving robotics industry for growth and sustained success. IAM Robotics received one of the largest venture capital investments in the Pittsburgh region in 2018 with $20 million to grow its presence.

"Pittsburgh is the reason we're here," said Reed. "It's important for us to be here because this is where a great deal of research, development, innovation and growth of commercial robotic companies takes place."

For more information, check out: iamrobotics.com.

ON THE RIGHT TRACK:

TELETRACKING HELPS HEALTH SYSTEMS IMPROVE QUALITY OF CARE

By **Elizabeth Byrnes**

As an innovative software company, TeleTracking believes it is unacceptable that patients are not able to access the care they need, when they need it, due to operating inefficiencies and unnecessary cost barriers. That's why for more than 28 years the organization has been dedicated to helping health systems improve access to quality care with an outcomes-based combination of people, process and technology—and a focus on saving lives and giving time back to caregivers. This commitment to delivering a positive experience for patients supports the mission to ensure that no patient will ever have to wait for the care that they need.

"TeleTracking has spent nearly three decades studying and addressing the issues of inefficiency in health care. During that time, we have developed THE operating platform with a focus on the patient, productivity and price. With this we have brought visibility to the 'invisible' problems in health care – the inefficiencies that cost lives and money," said Chris Johnson, President. "In addition, our focus on the underlying data has given us an opportunity to build the premier analytics platform for health care operations; providing hindsight into what has happened, so we can learn from it; insight into what is happening, so we can respond to it; and foresight into what will happen so we can prepare for it. These, along with our world class consulting and advisory services allow TeleTracking to influence behavior and improve the efficacy of health care operations in a way that no one can compete with."

A pioneer in operationalizing the care continuum, TeleTracking is headquartered in Pittsburgh and prides itself on a culture defined by a sense of compassion and humility in support of its mission. TeleTracking has had a 38% growth in headcount over the past three years. That expansion is due to the acknowledgment that health systems must improve their operations and the impact TeleTracking can have, including:

- Improving efficiency in unnecessary patient days, leading to more patients being served and dramatically reducing the average length of stay.
- Decreasing the amount of time waiting for a bed, decreasing the mortality rate and shortening the length of stay.
- Preventing patients from leaving when there are unoccupied hospital beds.

Not only is TeleTracking concerned with patient access to quality care, but their own employee wellness is integral to their culture. TeleWellness, its employee wellness program, focuses on physical, emotional and financial health and has a 75% participation rate. The program includes a best in class Wellness Fair, screenings, on-site wellness education, coaching, monthly on-site massages for employees and group wellness challenges.

Corporate citizenship is another tenet of the culture. TeleTracking is the founding sponsor of Mission of Mercy Pittsburgh, a free, two-day dental clinic for under-served people living in Pittsburgh and the surrounding area. A team of employee volunteers is also dedicated to identifying charities and planning events for the TeleCares program. Employees can support the charities that mean the most to them through both individual employee grants and paid volunteer days.

"Human resources is dedicated to nurturing our unique culture. It's important and it's a competitive advantage. There is depth to it and makes it possible to continuously attract the best and brightest to further our mission," said Keith Young, Senior Vice President of Human Resources. "It also drives employment recruitment, retention, engagement. It differentiates us in the market and it represents our values, brand and image."

Chris Johnson
President, TeleTracking

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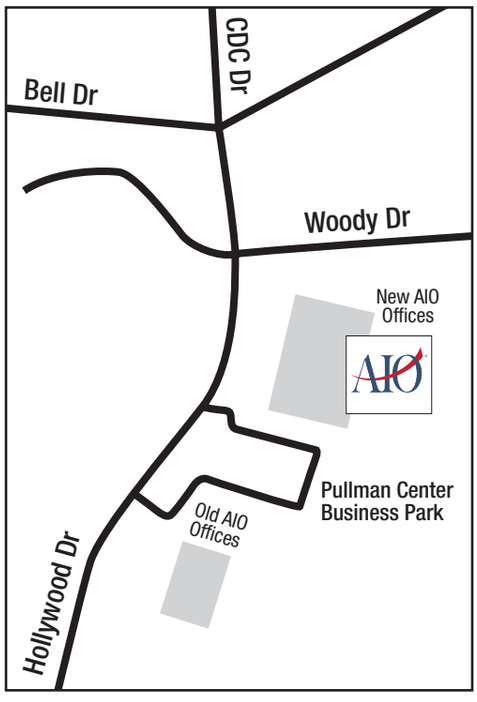

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AIO (Associates in Ophthalmology), Pittsburgh's trusted ophthalmologists, is the first practice in Pennsylvania to offer patients the 3D assisted microscopic retinal surgical technology, the NGENUITY® System.

The NGENUITY® 3D Visualization System is designed for more efficient surgery via better visualization of the retina anatomy. Alcon launched the system in collaboration with TrueVision®3D Surgical, a California-based company specializing in digital 3D visualization and guidance for microsurgery.

The NGENUITY 3D Visualization System is comprised of several elements, notably a High Dynamic Range (HDR) camera that provides excellent resolution, image depth, clarity and color contrast. With the three-dimensional view, the surgeon now has depth perception not previously available on standard television monitors, often used today in the operation theatre. Surgeons may also increase magnification while maintaining a wide field of view as well as use digital filters to customize his or her view during each procedure, highlighting ocular structures and tissue layers, which is imperative to visualize the back of the eye. Engineered with a specific focus on minimizing light exposure to the patient's eye, the NGENUITY 3D Visualization System facilitates operating using lower light levels.

"This digital platform offers more than just enhanced visualization. It will impact our therapies and the way we manipulate tissue," said Dr. Allen Ho, Professor of Ophthalmology, Thomas Jefferson University, and Director of Retina Research, Wills Eye Hospital, Philadelphia. "The easier it is for surgeons to perform these long, delicate surgeries, the better they can perform for our patients who count on us to provide them with the best possible care."

"At AIO, we are finding that the use of this technology is enabling us to perform retinal surgeries once deemed impossible," said Dr. Miguel Busquets, Vitreoretinal Surgeon and Director of the Division of Research and Clinical Trials at AIO. "The system allows for better outcomes due to the significantly improved resolution of tissue visualization under high magnification."

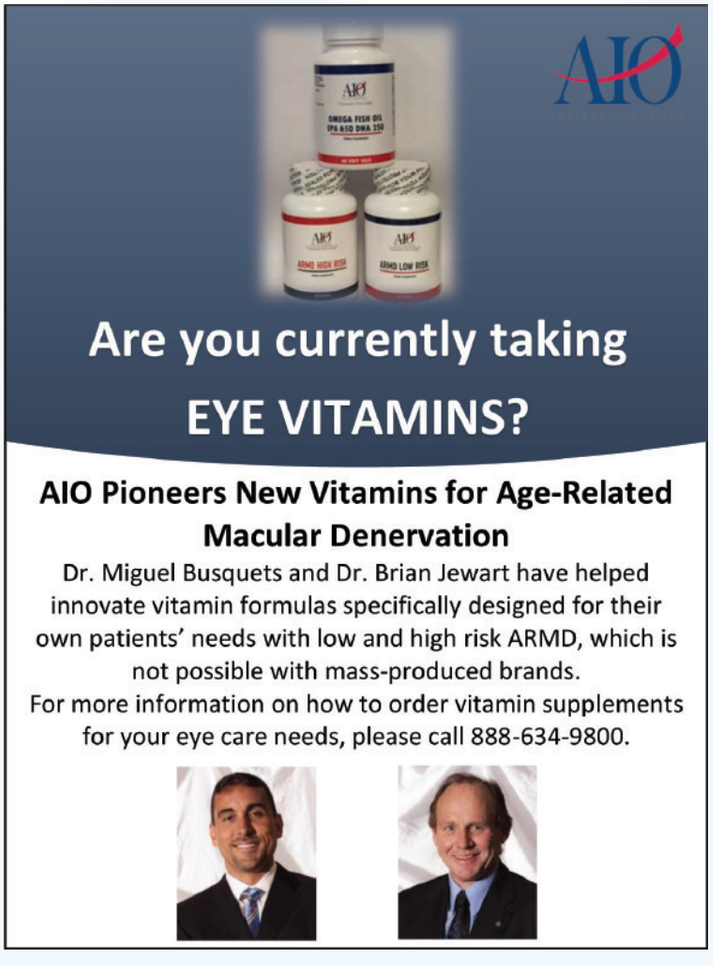
The system is designed to facilitate collaboration and teaching in the operating room. Offering an immersive panoramic surgical view, the NGENUITY 3D Visualization System allows the operating team to see exactly what the surgeon is seeing in real time.

"The NGENUITY 3D Visualization System takes vitreoretinal surgery to a more intuitive operating experience, offering greater depth and detail during surgery," said Mike Ball, CEO of Alcon. "Our goal is to provide surgeons with better visualization while operating on the back of the eye, facilitate teaching and ultimately improve patient outcomes."

About Vitreoretinal Surgery

Vitreoretinal surgery is a sub-specialty of ophthalmology focused on diseases and surgery of the back of the eye including the retina and the vitreous body of the eye. The retina is a light-sensitive area that includes the macula, which is made up of light-sensitive cells that provide sharp, detailed vision. The vitreous body of the eye is a clear gel that fills the space between the retina and the lens. The retina, the macula, and the vitreous body can all be subject to various diseases and conditions that can lead to blindness or vision loss and may require the attention of a vitreoretinal surgeon.

For more information on the NGENUITY® 3D Visualization System, call 1.800.246.1000 or visit AIOvision.com.



VALUE-BASED HEALTH CARE: WHAT DOES IT MEAN, AND HOW DO WE ACHIEVE IT?

James F. Jordan, President & CEO, Pittsburgh Life Sciences Greenhouse
Sr. Director, Health Care & Biotechnology Programs
Distinguished Service Professor in Health Care & Biotechnology Management
Carnegie Mellon University

It might come as a surprise to some that over the past 100 years, U.S. Presidents from both parties have been concerned about health care; how it's offered, who receives it, how it's priced, and how to measure its effectiveness. Franklin Pierce, Theodore Roosevelt, Franklin Roosevelt, Harry Truman, Lyndon Johnson, Richard Nixon, Jimmy Carter, Bill Clinton, George Bush, Barack Obama and Donald Trump — all put forth initiatives.

Historically, health care providers have been compensated on a fee-for-service basis. Quality measurements were based on the results of a procedure. Financial success was measured by the output of services and revenue. The system was motivated to measure at the procedural level (micro) versus the health systems level or at the level that really matters, population health (macro). Unfortunately, the unintended consequence of this practice is the promotion of volume over outcomes.

Why we need to shift to a value-based care model

The result of this type of behavior is evident when one tracks the average year-to-year growth in national health care expenditure (NHE) by decade. The table outlines the last six decades, and we can see double-digit growth through the 1980s and then a dramatic drop in 2010 through 2017.

Why did NHE growth slow down dramatically in the past decade? The Affordable Care Act (ACA), passed in 2010, seems to have influenced the slowing of growth. The details and debates on the components of the ACA, the pros and cons, are beyond this short article. However, the numbers are indisputable.

The ACA focuses and realigns the incentives of health care to be measured on a basis of value, which requires improving quality and increasing access, all while decreasing costs. This is the true definition of value-based health care.

Decade	Years	Average NHE growth rate
1960's	1960 - 1969	10%
1970's	1970 - 1979	13%
1980's	1981 - 1989	11%
1990's	1990 - 1999	7%
2000's	2000 - 2009	7%
2010's	2010 - 2017	4%

Source: BEA, CMS tables

So why must we continue on the path towards value-based care? The real concern is when we compare the growth of the economy as a whole, called gross domestic product (GDP), to the growth of health care expenditure. Over the same six decades, health care expenditure growth is simply outpacing the growth of our economy, consuming a larger percentage of our financial output. In the last decade, while the rate of health care grew by 4%, GDP grew only 2.15% — nearly half the rate of NHE.

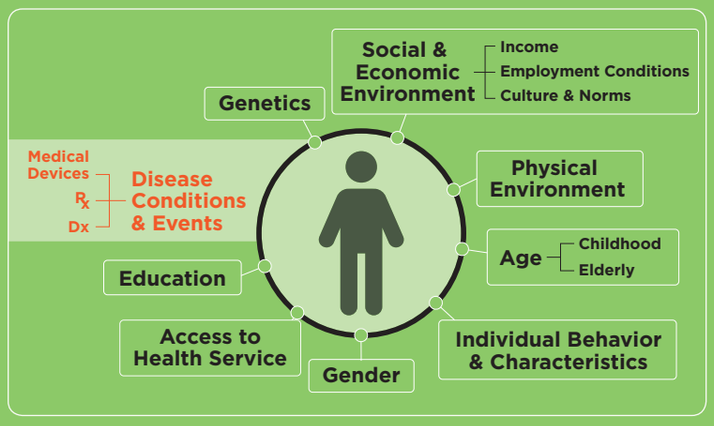
This inhibits us from investing in other activities as a nation, such as research and development to keep the U.S. competitive. To equate this to a personal budget, if electricity and rent take up a greater and greater percentage of your budget each year, it limits your ability to invest in an education, save money or increase discretionary spending.

Social determinants of health are critical to achieving value-based care

So now that we know why we need to achieve value-based care, how do we do it? To deliver value-based care, we must know more about patients. Understanding what causes disease in the body is a critical first step.

There are numerous types of diseases: infectious, hereditary, psychological and diseases of deficiency. Our environment can trigger disease (called epigenetics) and can also be influenced by other social determinants, such as lack of education and poor individual behaviors. Social determinants of health are the conditions in which we are born, grow, live, work and age which are influenced by the distribution of money, power and resources at global, national and local levels.

For example, Chronic Obstructive Pulmonary Disease (COPD) is a progressive lung disease making it harder to breath and decreases one's long-term health. Personal behavior, like smoking, and



environmental influences, like lung irritants such as air pollution and chemicals in the work place, can causes this disease.

When you shift the paradigm of the health care system to value, and health care delivery is no longer motivated to focus on "health events," a desire to incorporate social determinants of health and genetics becomes extremely important to value measurement. To effectively manage disease, you need to know all of the aspects that influence an individual, and that requires the ability to amass a large amount of data and analyze it efficiently. This is where big data and data analytics will play a critical role in helping us to transform health care as we know it.

Advanced Information Technology: Leading the way to value-based health care

In 2017, consumers spent $333 billion on prescription drugs. There has been a national outcry to decrease drug prices, but why are they so expensive in the first place? One of the reasons is the process of how drugs are discovered. Do you recall from your high school education the scientific method? It's basically a six-step process: (1) ask a question, (2) research, (3) construct a hypothesis, (4) test the hypothesis, (5) analyze the data and draw a conclusion, and (6) share the results to start the learning cycle again. This is what a typical drug development process looks like. It's costly because of the long learning cycles and high failure rates. But what if we could shorten timelines with better input? And what if we could determine failure sooner to decrease costs and redirect resources?

> The system was motivated to measure at the procedural level (micro) versus the health systems level or at the level that really matters, population health (macro).

This is just what big data, machine learning and artificial intelligence (AI) are striving to do. Increased data allows the application of data analytics to improve the efficiency in care delivery, and the application of AI makes our decisions more timely and more accurate. Machine learning uses multiple AI algorithms to parse and learn for itself. Evidence of this eventuality can be seen today in drug trials whose hypotheses are constructed by applying AI to known patient-derived trial data.

Few people appreciate that the biotechnology, diagnostics and pharmaceuticals sectors are linked in decreasing the cost of prescription drugs and making drug discovery and commercialization more efficient.

Biotechnology uses living cells as tools to mirror the workings of normal and diseased cells to increase drug discovery and predict early failures. Why is early failure prediction so important? Because the cost of failure is inevitably spread into the price of marketed drugs.

Another data-driven trend is precision medicine (PM). PM uses genetic and molecular profiling data to match a patient with the treatment that provides the most therapeutic benefit. Using these tools, we can uncover disease patterns with the goal of getting the right treatment to the right patient, catching disease earlier, treating it more effectively, and saving the system money.

Will industry champion a health care paradigm shift?

Not only is advanced technology like AI and machine learning transforming health care, but also industry is combining to advance new ways of looking at the health care system as a whole.

Many large companies self-fund their health insurance. Instead of paying an insurance company to cover their employees, these companies assume direct financial responsibility for the cost of enrollee medical claims.

In January 2018, Amazon, Berkshire Hathaway and JP Morgan Chase announced a major collaboration to build an independent, nonprofit health care company. Haven is focused on improving outcomes (including access and quality) and reducing costs.

Why is this important? Today's health care delivery is a kluge of historic system architectures and internal cultures that are frequently hard to change. By partnering and funding health care delivery, Haven is not burdened by infrastructure, not burdened by cultures, and will only fund those activities that optimize outcomes. Although it's too early to know, could this be the catalyst that changes the face of insurance and health care delivery?

One thing we know, the past will not be our future

Presidents for 100 years have been concerned about health care, and in 2010 a convergence of economic pressures and political forces passed the ACA legislation. This legislation has had impact and was intended to evolve over time. It established goals focused on outcomes, allowing time, technology and disruption to avail themselves and continuously improve the system.

Our most recent continuous improvement cycle recognizes that social determinants of health may be one of the biggest contributors to improvement. Although advanced technologies can help gather new information and improve decision-making, our historical infrastructure and cultures can deter disruptive change. Will the large, self-funded companies and partnerships such as Haven be that irritating grain of sand in the oyster that produces a pearl? Time will tell.

PITTSBURGH: FOCUS ON BASICS TODAY, SMARTER CITY TOMORROW

By **Dmitri Shiry,** Deloitte

In 2017, Pittsburgh was one of the five finalists in the Federal Department of Transportation's Smart City Challenge. And while Columbus ended up taking home the top prize (a $40 million grant), there are a few things Pittsburgh can learn from Columbus to help move the needle to becoming a smarter city.

But where to start? For Pittsburgh, transportation is expected to play a key role in the city's long-term achievements.

Advancing autonomous vehicles

With companies like Uber and Argo AI planting roots in Pittsburgh, autonomous vehicles have become one of the biggest driving forces in making the city "smart," with talent from the region's schools helping to fuel the future of connected vehicles.

Although safety has been a top concern for many consumers around the world (causing support for autonomous vehicles to hit a bit of a plateau), most Pittsburgh-based autonomous vehicle companies continue to focus on improvements to make safety their top priority.

And while it could still be years before autonomous vehicles are fully commercialized, Pittsburgh's tech companies still believe that autonomous vehicles will play an important role in the future of mobility.

Hitting pause on personal vehicles

As more and more people flock to urban areas, finding ways to reduce congestion and increase the use of public transportation could continue to be a challenge. While cities like Pittsburgh heavily rely on personal vehicles, local governments around the country are placing more emphasis on ways to require the use of public transportation.

Creating convenient and affordable insights from the beginning to the end of a journey (bike-sharing, dynamic shuttles that adjust routes based on demand, and ride-hailing) can help reduce reliance on personally owned vehicles.

Regardless of the specific strategies used to help modernize mobility and optimize public infrastructure, many expect a single digital platform to be a critical part of the equation, helping to connect data related to physical infrastructure, modes of transport, and transportation service providers.

Going back to the basics

But even as nearly every aspect of our lives becomes increasingly digital, mobility at its core remains grounded in the physical world. For transportation officials, that means there's no substitute for ensuring that physical infrastructure and assets work (e.g., roads and bridges are maintained and safe, that buses, trains, subways and other forms of mass transit are clean and reliable, and that traffic lights function).

That said, it's easy to become enamored with the array of emerging mobility technologies entering the market. Leaders can benefit from taking a deliberate and calibrated approach with respect to embracing the latest technologies while being laser focused on getting the fundamentals right. Said another way, we can't overlook the basics.

Given the speed of change and technological trends, any city has the opportunity to remake its mobility landscape over the next 5-10 years. With the many business, academic, civic and governmental assets that we can leverage within our region, could Pittsburgh become the next leading smart city?

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STARTUPS AND THE LAW:

The Legal Issues that Can Shape the Trajectory of Tech Startups

By, **Derrick L. Maultsby Jr.**, and **Jason L. Ott, Esq.**, Dickey McCamey

It can be extremely difficult for companies to navigate the legal requirements associated with conducting business on a daily basis. While large companies are staffed with in-house counsel to deal with the legal implications of their operations, smaller companies are not always fiscally able to employ such help. Specifically, tech startups often can struggle in that regard.

While some startups are able to overcome having no legal counsel early in their development, many startups can experience significant negative consequences without legal direction and advisement at that stage, potentially resulting in stunted growth or ceasing operations altogether.

Some common legal obstacles facing startups are the following:

- Issues with corporate formation and governance;
- Ownership of intellectual property;
- Skillfully drafting contracts and completing commercial transactions; and
- Compliance with business/industry specific regulations.

Corporate Formation and Governance

From the outset, a startup has substantial legal challenges, concerning which many of its founders likely are not aware. Deciding which legal entity to choose is vital as a first step into the business venture. Choosing the wrong legal entity can have potentially devastating consequences as it seeks to develop and grow. Further, having an understanding of the regulations and laws that govern a company's business and industry is imperative to carry on compliant, responsible business practices. A misstep in this early decision making process and associated corporate legal compliance can significantly limit a startup's business opportunities and development.

Ownership of Intellectual Property

Most startups offer customers innovative services and products. Those services and products are the intellectual property that the startup owns. Much (if not all) of the value of a startup lies in that intellectual property. Thus, protecting that value is of the utmost importance. To do so, startups must take active steps, including entering into written contracts with anyone to whom they might plan to disclose such intellectual property, applying for patent, trademark, or copyright protection, drafting employment contracts with an eye toward intellectual property protection, and safeguarding their intellectual property with strong access control.

Contracts and Commercial Transactions

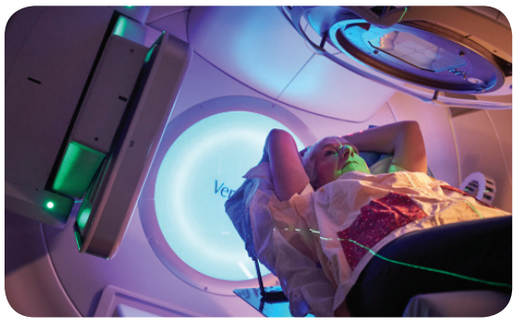
Drafting and reviewing contracts can be mundane, but failing to complete those tasks comprehensively from a legal perspective can have drastic consequences. By entering into a contract, of course, any business is legally binding itself to the terms of that contract. It is imperative throughout the contract negotiation, drafting, and agreement stages that a startup completely understands the implications of the provisions and language in that contract and what those provisions might mean from a business/technological development standpoint moving forward.

General Compliance

Tech startups are leaders in innovation that help pre-existing industries and businesses to evolve. When operating within these various spaces, there are various commercial, governmental, environmental and other regulations that may come into play. Startups must be familiar with all applicable regulations so that they can ensure compliance within all such legal requirements. Further with a constantly growing and evolving technological landscape, legal regulations concerning tech companies specifically are always proliferating. That proliferation requires consistent research and updates on new and developing relevant laws and regulations for corporate compliance on a daily basis and far into the future.

Takeaways

While we summarized a few of the legal challenges that tech startups face, there are a wide range of additional issues that may confront them. It is important that smaller tech companies and tech startups seek out the legal counsel that they need. While it may not be feasible to hire in-house legal counsel, there are other options available for guidance. In connection with that, our firm is interested to collaborate with tech startups and similarly situated companies early in the developmental stages of those businesses to provide guidance on these extremely important topics, with the intentions both of helping the Pittsburgh tech community to continue to develop and thrive and of establishing longstanding business relationships with those future clients.



A linear accelerator at the AHN Cancer Institute.

WORLD-CLASS ONCOLOGY CARE AT AHN CANCER INSTITUTE COMMUNITY LOCATIONS

In the last few decades, treating cancer has evolved from not only determining how to cure the disease, but also how to preserve a patient's overall health and quality of life during treatment and well into their future.

At AHN Cancer Institute, expert physicians work together to develop innovative and effective approaches to prevent, detect and treat cancer, allowing oncologists to tackle even the most complex forms of the disease. And by bringing this high-quality care close to where a patient lives or works, AHN can help patients achieve the best possible treatment outcomes while reducing the overall impact to their everyday lives.

Breaking through cancer with innovative therapies

The AHN Cancer Institute is contributing significantly to the medical ingenuity that aims to detect and combat cancer at all stages. One of the latest advances includes Chimeric Antigen Receptor (CAR) T-cell therapy, an immunotherapy that alters a person's own cells to recognize and attack cancer.

Playing a vital function in the body's ability to fight disease, T cells are immune system cells; however, sometimes T cells don't effectively recognize and fight cancer cells. At AHN, a patient's white blood cells are gathered during a procedure called "apheresis," and they are then sent to a laboratory for processing. The T cells are separated and modified to create an artificial receptor on their surfaces. These artificial receptors are called CARs and allow the T cell to find and destroy the cancer. When enough CAR T cells are produced in the laboratory, they're frozen and sent to the patient's treatment center where they're thawed and returned to the patient via an intravenous infusion.

Hyperthermic Intraperitoneal Chemotherapy

AHN Cancer Institute is also one of the few centers in the country treating patients with advanced abdominal cancers using an innovative treatment called Hyperthermic Intraperitoneal Chemotherapy (HIPEC). During HIPEC, the surgeon removes all visible signs of cancer and then bathes the peritoneum with heated chemotherapy to kill any remaining cancer cells left behind and to prevent new cancer growth.

The decoding of cancer, or genetic profiling, is another exciting advancement that is creating new pathways for treatment of the disease. The human genome is our full set of DNA — the building blocks of our cells. Doctors know that cancer results from changes to DNA. Cancer genomics compares the DNA of cancer cells to that of healthy cells. The results can reveal the genetic cause of tumor growth — and help doctors identify and deliver the most effective treatment.

AHN experts collaborate about treatment plans.

AHN Cancer Institute specialists collaborate with genetic experts at Johns Hopkins Kimmel Cancer Center as part of a tumor board known as GAITWAY, which stands for Genetic Alteration in Tumors with Actionable Yields. In this meeting, oncologists, genetic experts and molecular pathologists from AHN and Johns Hopkins review tumor sequencing reports and determine targeted therapies. GAITWAY is particularly effective in determining treatment options for patients with advanced or rare tumors.

Personalized care at every turn

As the U.S. population continues to grow older, the number of cancer diagnoses is rising. About 1.7 million new cancer cases — 81,000 in Pennsylvania alone — are expected to be diagnosed in 2018, a 2-percent hike from 2015, according to the American Cancer Society.

Addressing the increasing cancer needs of western Pennsylvania residents, AHN and Highmark Health have invested nearly $300 million to expand and enhance services. The goal is to make high-quality oncology care more accessible.

"The reason it's very important for a cancer patient to receive their care as close to their home and community as possible is that cancer care does not take place over a day, a week, a month; sometimes it takes many months and sometimes years," said David S. Parda, MD, chair, AHN Cancer Institute. "We know that it's best for each patient's overall health and well-being to deliver their care where their support system is located."

This year, the AHN Cancer Institute is adding to its existing 20 locations with five new state-of-the-art facilities. Three have already opened:

The AHN Cancer Institute in Butler County brings treatment closer to the patient.

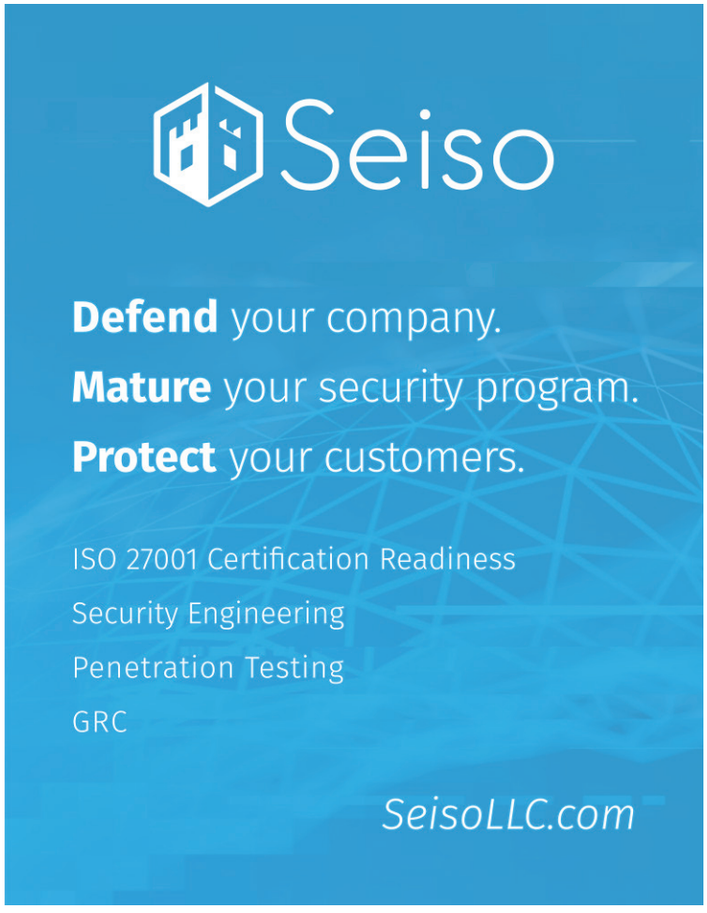
in Monroeville on the Forbes Hospital campus; in Center Township, Butler County; and in Monaca, Beaver County. Later this year, new facilities will open in Hempfield, Westmoreland County and on the campus of Saint Vincent Hospital in Erie.

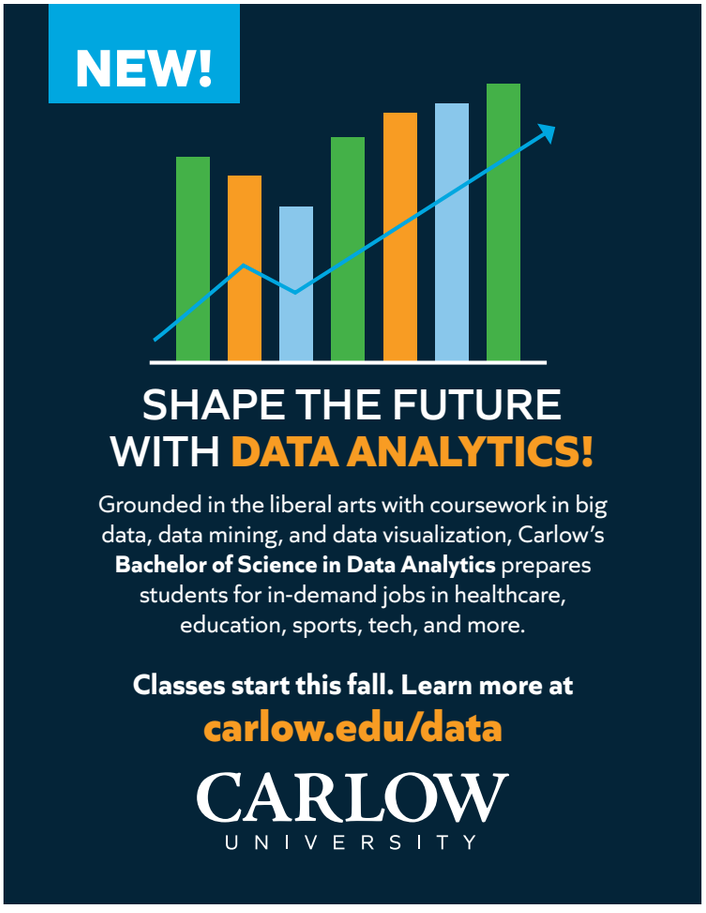
Also part of this investment is the AHN Cancer Institute Academic Center at Allegheny General Hospital to serve as the nucleus of collaborative cancer research. Physicians and researchers will test advancing technologies, diagnostic tools, and treatments that will be implemented throughout the AHN Cancer Institute community network when proven to be safe and effective.

The new AHN Cancer Institute community locations offer advanced radiation therapies, immunotherapy, and chemotherapy, as well as access to support services such as oncology rehabilitation, genetic counseling, pain management, and behavioral health services. Patients can also feel confident that their care plan is a completely collaborative effort. They can typically receive all of their treatment close to home, but at the same time, their care is closely connected to academic specialty programs at Allegheny General Hospital and West Penn Hospital, and through AHN's collaboration with Johns Hopkins Kimmel Cancer Center.

Each AHN Cancer Institute patient is supported by a personal nurse navigator who coordinates the patient's care, explains treatment plans, helps to manage their side effects, informs them about clinical trials and support services, and guides them through health insurance benefits.

"At AHN, our primary focus has always been on our patients and their families," Dr. Parda said. "This is why we have multidisciplinary oncology experts collaborating to develop plans that optimize patients' treatments, provide this expert care in our patients' communities, and build a network of clinical professionals around each patient to help ensure that every one of their needs is addressed."





ROLL CALL

There is strength in membership, and the Pittsburgh Technology Council's membership is stronger than ever. Here's a snapshot of our members as of 5/1/2019.

Artificial Intelligence

Allvision IO
APTIV
Argo AI
Carnegie Mellon University, Center for Machine Learning and Health
Cognistx
Eye-bot Aerial Solutions
Locomation Inc
Lyft
Marinus Analytics
Mine Vision Systems
Near Earth Autonomy
Panacea AG
Petuum
Precivision Technologies, Inc.
RoadBotics
TrademarkVision
Uber

Associations/Institutes/Societies

African American Chamber of Commerce
Allegheny Conference on Community Development and Affiliates
American Middle East Institute
Consulate General of Canada
Department for International Trade
PA Chamber of Business and Industry
Pittsburgh Airport Area Chamber of Commerce
Pittsburgh Business Show
Pittsburgh Downtown Partnership
Pittsburgh Social Exchange LLC
Pittsburgh Technology Council
South West Communities Chambers
Southpointe Chamber of Commerce

Consulting

Agility IT Services
AJ Consulting Group
Align Leadership LLC
All Water Systems Inc.
Allegheny Science & Technology
Andrew Lesniak Consulting
Armada Supply Chain Solutions
Aspirant
Avanade, Inc.
Bill Kristan
Bit-x-Bit, LLC
BiznessLegion, LLC
Blue Water Growth, LLC
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Business Forward, Inc.
Caliguiri Group
Campus to Career Crossroads
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Catalyst Pharmacy Consulting LLC
Citrin Consulting
Compass Business Solutions Inc.

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ConsultUSA and PMCentersUSA Solutions Provider
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Cowden Associates, Inc.
Cowden Associates, Inc.
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Elizabeth Greenwald
Emrgtech LLC
Engaged Prospect
Essential Systems, Inc./ ES Linux Group
Fifth Influence, Inc
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Good Future Innovation LLC
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Prequel Solutions LLC
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Real CIO Consulting
Resilient Cognitive Solutions
RG
SDLC Partners L.P.
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Sogeti
Solutions 21
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Strayer Communication, Inc.
Sultan Interactive Group
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Techmite, Inc.
Technical Solutions, Inc.
Techstra Solutions
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Cube Creative Space
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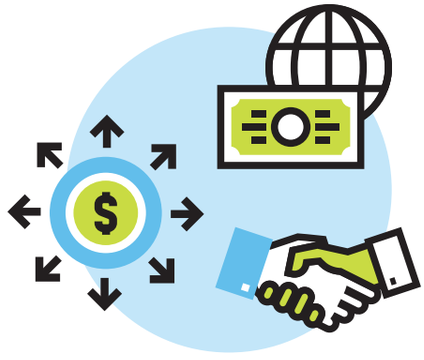

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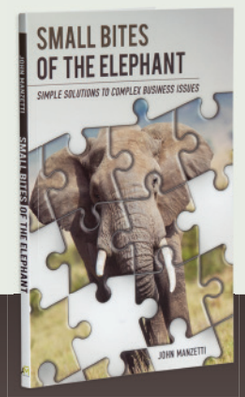
SMALL BITES OF THE ELEPHANT
by John Manzetti

Definitely not boring. Loved the simplicity of it and the "small bites" approach.
- Bill Flanagan - Chief Corporate Relations Officer, Allegheny Conference, Host of "Our Region's Business" WPXI TV, Pittsburgh

A logical and common-sense guide to a variety of business issues. It is a must read.
- George H. Kingsley - Principal, Avison Young, Pittsburgh



John has taken his real-world experience and translated it into sound simple solutions for both the expert and novice entrepreneur.
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