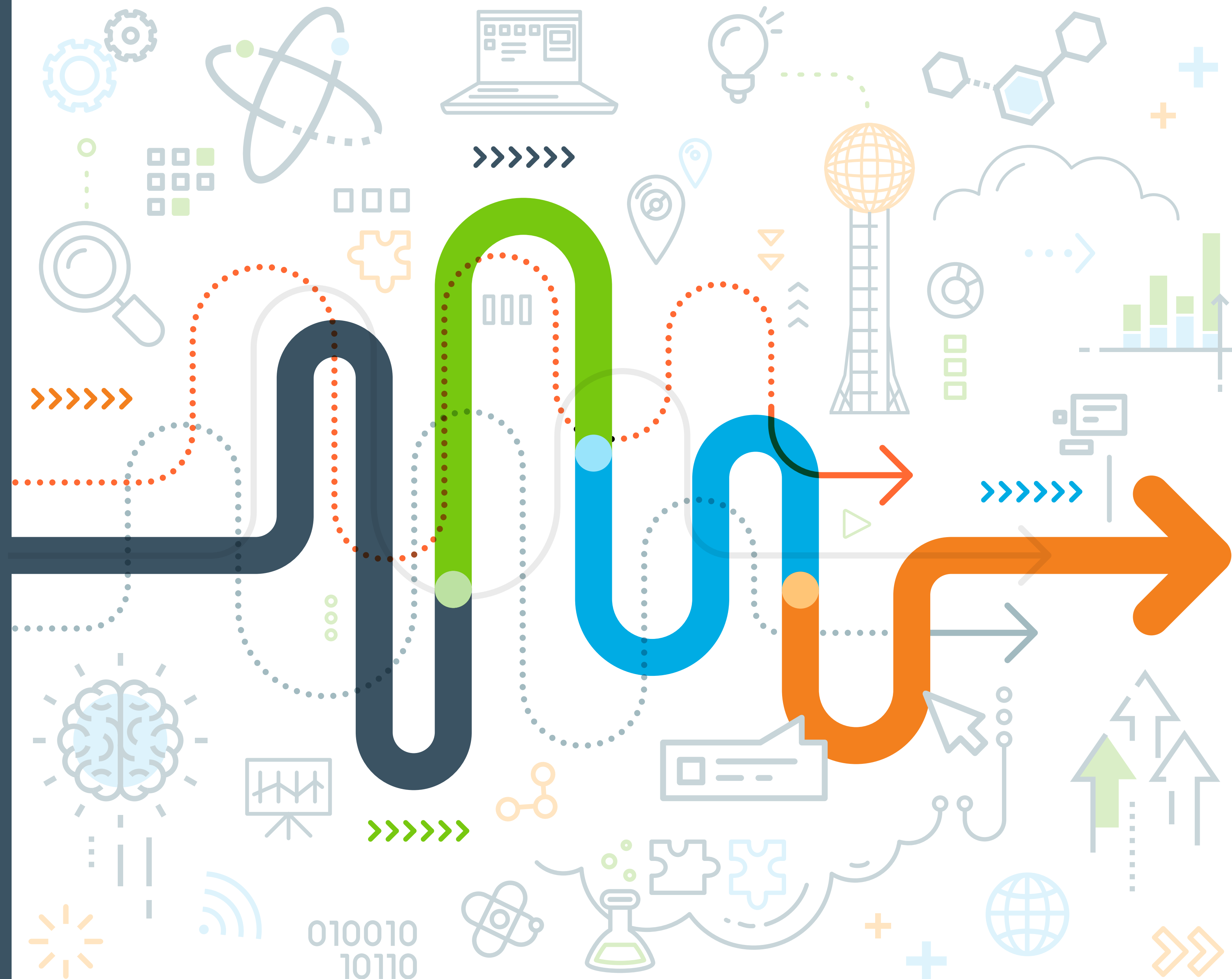


Knoxville Innovation Report 2023



Driving regional
economic prosperity.



Innovation Drives Robust Economies

The global economy is expected to experience a transformative shift from the third industrial revolution (i.e., the Digital Age) to the fourth, what Next Conference's Martin Recke identifies as the **"Imagination Age."** Among many other technological advances, fully autonomous vehicles, individualized medications, and wholly 3D-printed buildings could become normal parts of our everyday life.

The purpose of this report is to **assess the innovation economy of the Knoxville region** by identifying industry sectors and occupations that are best aligned with the future trends of the "Imagination Age," as well as the opportunities and challenges the region faces in becoming a leading hub in innovation, technology, and research and development (R&D).



The Starting Point

#31

In early 2020, the Brookings Institution identified the top thirty-five regions with the potential to be the country's innovation growth centers. Using a ranking system based on population, university STEM (science, technology, engineering, and math) R&D per capita, patents per 100,000 in population, STEM doctoral degrees per 100,000 in population, and innovation sector job share, Brookings developed an "Eligibility Index." Per their results, **the Knoxville area checked in at number 31**, just ahead of communities such as Charlotte and Birmingham, but behind peer regions like Lexington, Nashville, and Greenville.



Innovation Industries & Occupations



There seems to be no official or universally accepted definitions of which industry sectors and occupation groups are genuinely “innovative.” Unofficial definitions will differ by region due to the variations of existing industry clusters and regional innovative aspirations that make each area unique.

For the Knoxville Metropolitan Statistical Area (MSA), the Knoxville Chamber has identified 35 industry sectors as “innovation industries” and 58 occupation groups as “innovation occupations.” (For full list of the innovation industries and occupations, see appendices 1. and 2.)

Innovation Industries Impact*

33,629
Jobs

\$110,938
Average Annual Wage

Innovation Occupations Impact*

18,968
Jobs

\$94,400
Average Annual Wage

*As of Q3 2022

Source: JobsEQ; Knoxville Chamber analysis

Knoxville area’s ranking in change in innovation industries employment change between 2005 – 2017. Ranking indicates a net positive change of 1,223 jobs.

#23

Source: Brookings Institution; Knoxville Chamber analysis

Innovation Assets

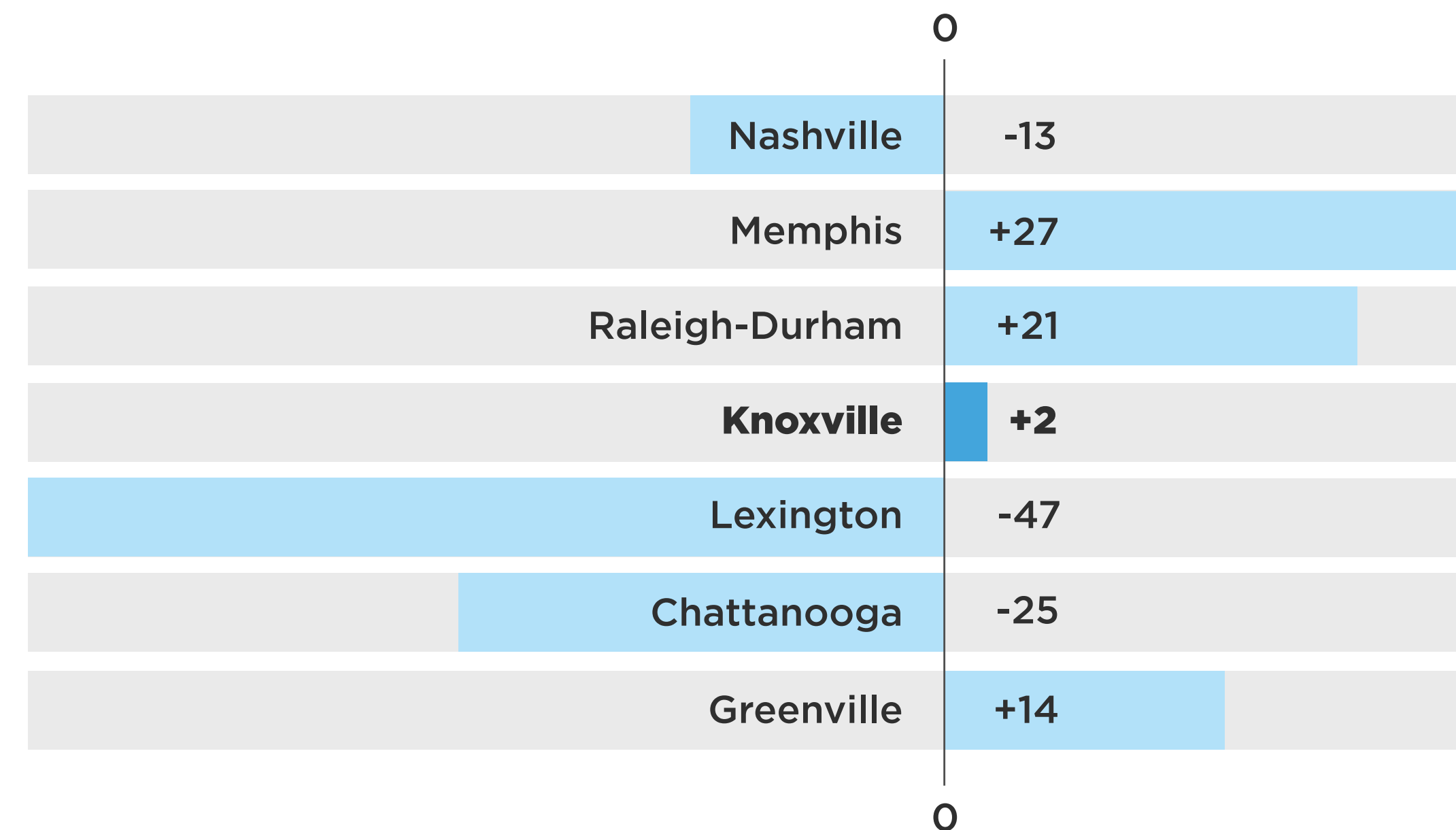
- 1 University of Tennessee Knoxville
- 2 Tennessee Valley Authority
- 3 Oak Ridge National Laboratory
- 4 UT Research Park at Cherokee Farm
- 5 Electric Power Research Institute
- 6 Manufacturing Demonstration Facility
- 7 National Transportation Research Center
- 8 University of Tennessee-Oak Ridge Innovation Institute



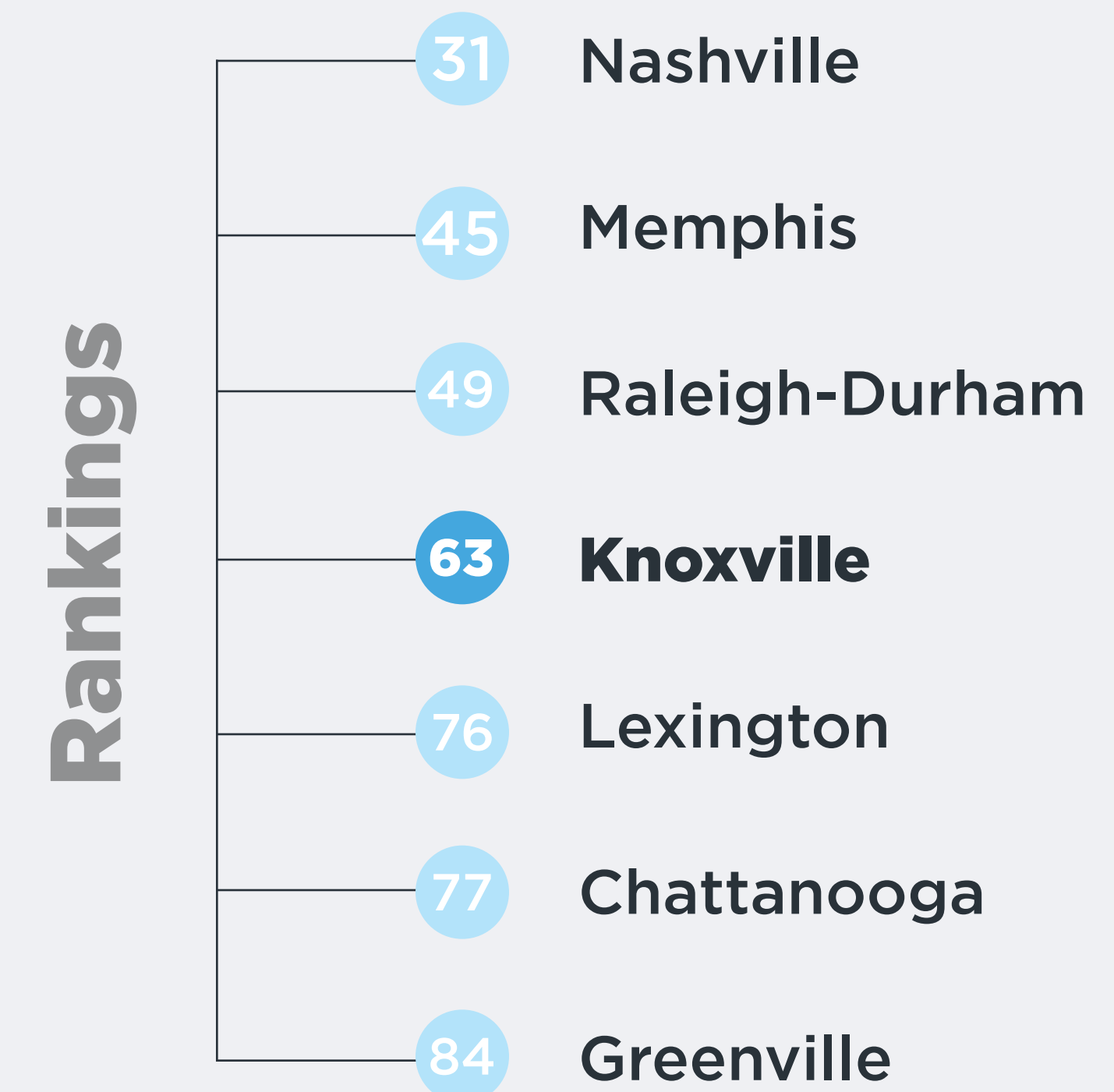
#63

The 2022 Innovation Cities™ Index determined that **Knoxville is 63 out of 118** U.S. cities in their innovation ranking.

Innovation Cities™ Index (Peer Cities - YOY Change)



2022 Innovation Cities™ Index (Peer Cities)



Technology, in and of itself, does not necessarily correlate to innovation within a community, but it has proven to be a strong indicator. Each year, since 1999, the Milken Institute has produced its Best-Performing Cities report. The report ranks the Top 200 large communities by indicators such as job growth, wage growth, and broadband access.

It also ranks high-tech concentration as well as five-year high-tech GDP growth and year-over-year high-tech GDP. The Knoxville area ranked 93rd in high-tech concentration, 55th in high-tech GDP between 2016 and 2021, and 111th in high-tech GDP between 2020 and 2021.



#93

**High-Tech
Concentration**

#55

**High-Tech GDP
2016 - 2021**

#111

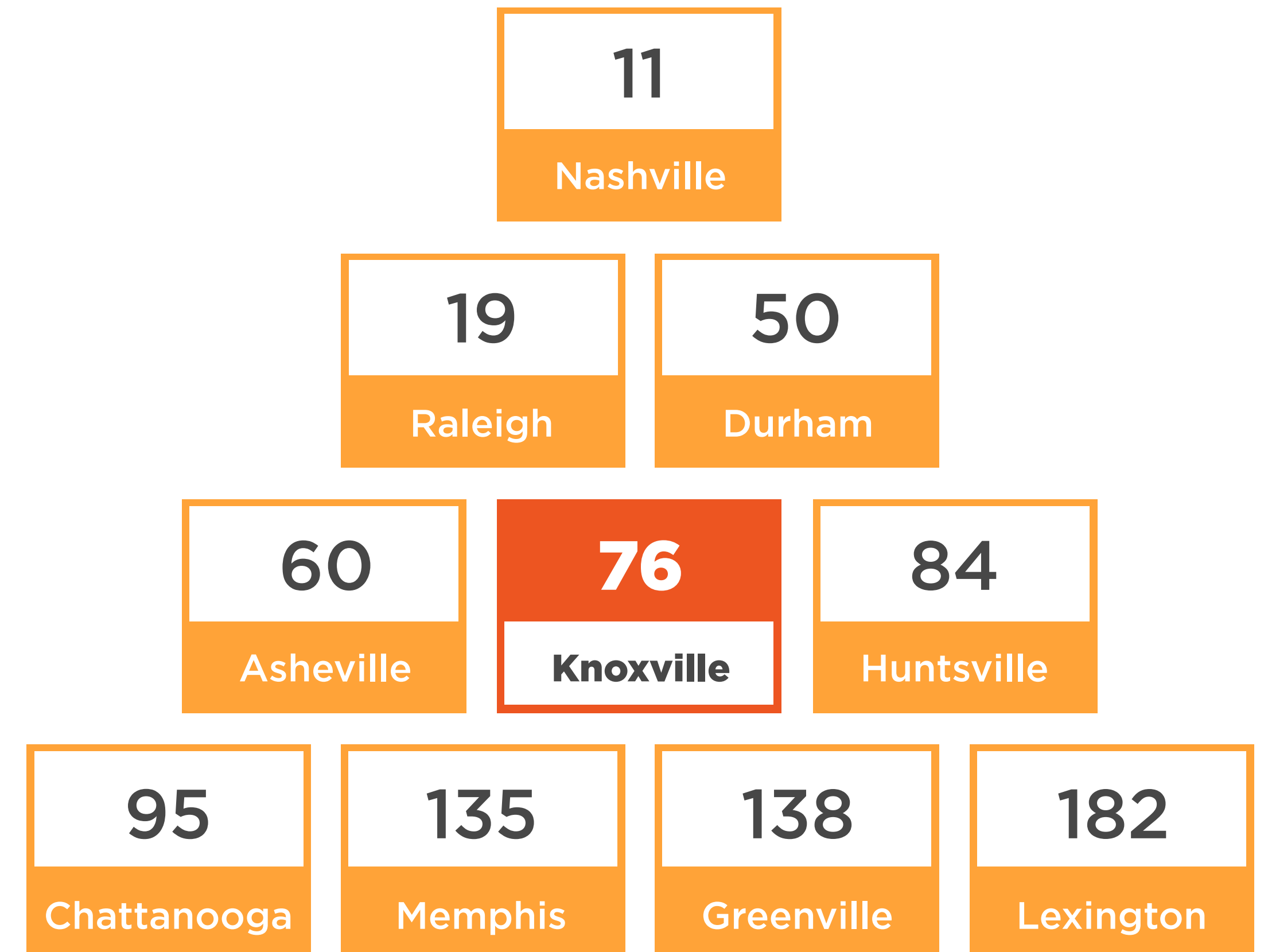
**High-Tech GDP
2020 - 2021**

Out of 200 Large U.S. Communities

Another trait of innovative communities is their economic dynamism. Heartland Forward, a non-profit think tank focused on the economic vitality of the middle U.S., produced their list of the most dynamic regions.

According to the organization, “America’s top metropolitan areas are joined by at least one common thread – an affinity for innovation.”

The rankings evaluates young firm employment share, young firm knowledge intensity, per capita personal income, and employment growth among other indicators. Of the 384 communities, Knoxville ranked a respectable seventy-sixth.



Peer Rankings

Source: Heartland Forward; Knoxville Chamber analysis

There is a distinct connection between educated communities and innovative ones.

With that as background, WalletHub ranked the Top 150 most-educated regions based on educational attainment and quality of education and the attainment gap.

Knoxville ranked

90th.

Most-Educated Regions (Peer Communities)

7 Durham

8 Raleigh

21 Huntsville

24 Lexington

28 Asheville

48 Nashville

90 Knoxville

95 Greenville

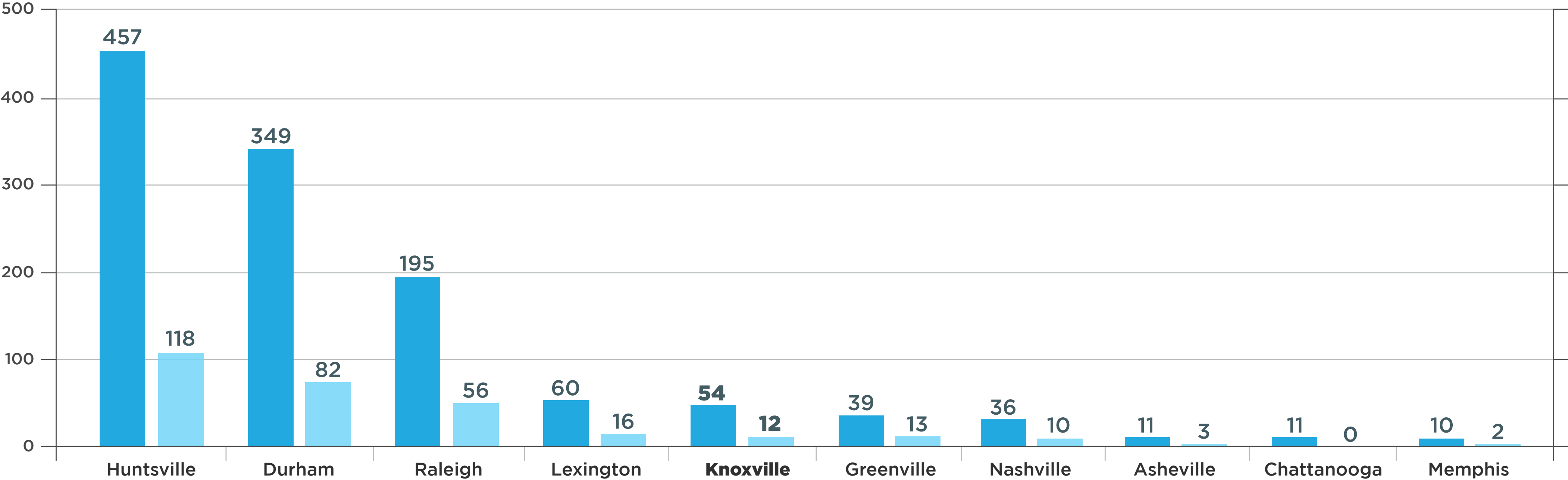
104 Memphis

112 Chattanooga

Source: WalletHub; Knoxville Chamber analysis

Five-Year SBIR and STTR Award Totals

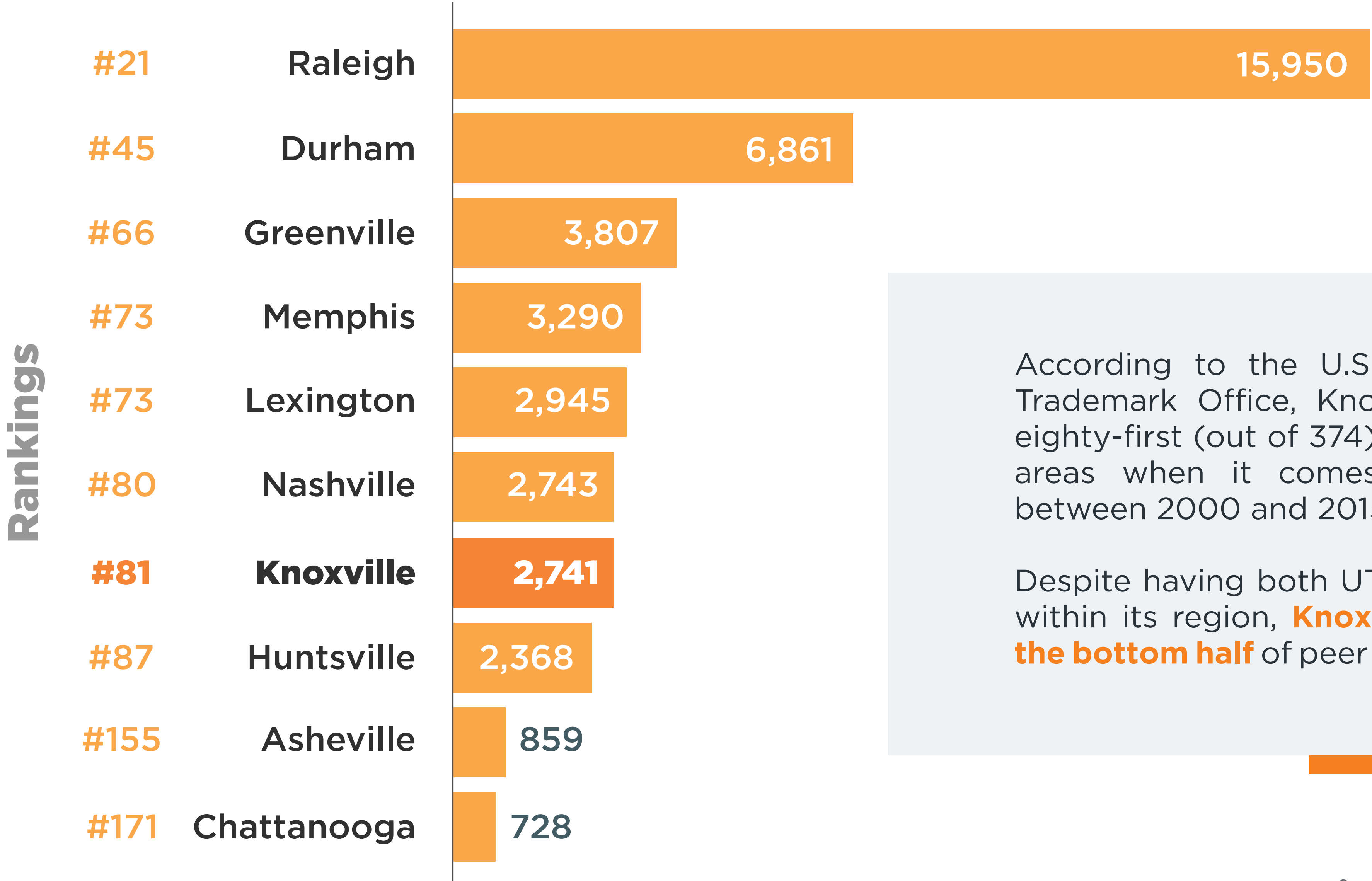
(2018 - 2022)



The **Small Business Innovation Research (SBIR)** program is a federal funding program that awards grants or contracts to small businesses to conduct research and development (R&D). The **Small Business Technology Transfer (STTR)** program is very similar to the SBIR program except that the STTR requires the small business to partner with a research institution which must be awarded a minimum of 30 percent of the total grant funds.

SBIR/STTR grants are awarded annually to nearly 5,000 startups and small businesses throughout the nation. In 2022, there were 12 SBIR awards in the state of Tennessee (of which five or 42% of the awards were in the Knoxville MSA). There were also nine STTR grant recipients in Tennessee (four of which were in the Knoxville MSA).

Patents Issued Between 2000 and 2015

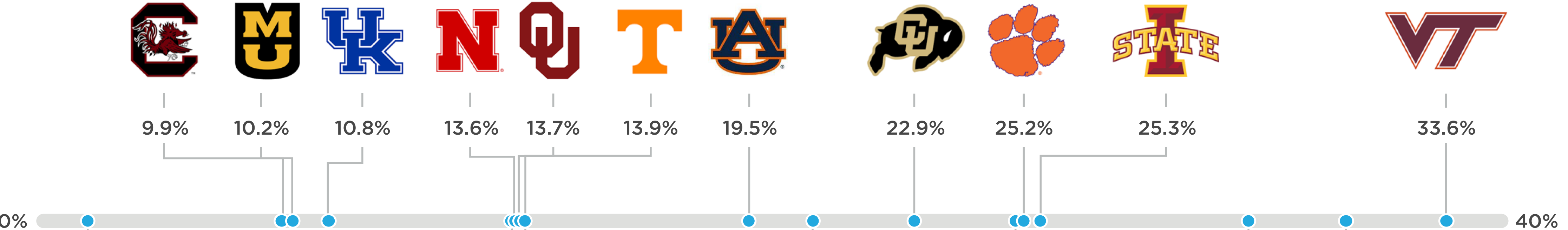


According to the U.S. Patent and Trademark Office, Knoxville ranked eighty-first (out of 374) U.S. regional areas when it comes to patents between 2000 and 2015.

Despite having both UTK and ORNL within its region, **Knoxville ranks in the bottom half** of peer communities.

Innovative communities need **engineering talent**. The talent typically is a product of four-year post-secondary institutions. The percentage of engineering student enrollment allows comparison between schools factoring in the size of the student population. Below is UTK's percentage as related to their stated comparable and aspirational peers.

UTK Comparable Peers

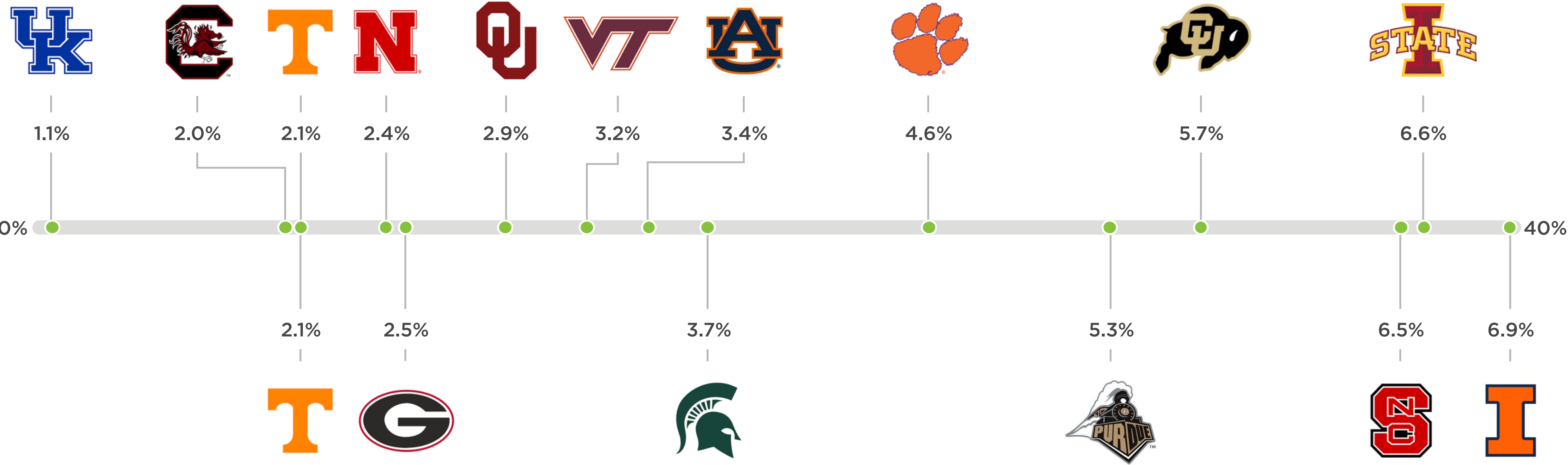


UTK Aspirational Peers



Computer science talent is becoming equally important as their engineering brethren. Below is the same comparison as shown on the previous page. (Note: Penn State University and the University of Missouri – Columbia do not report their computer science enrollment.)

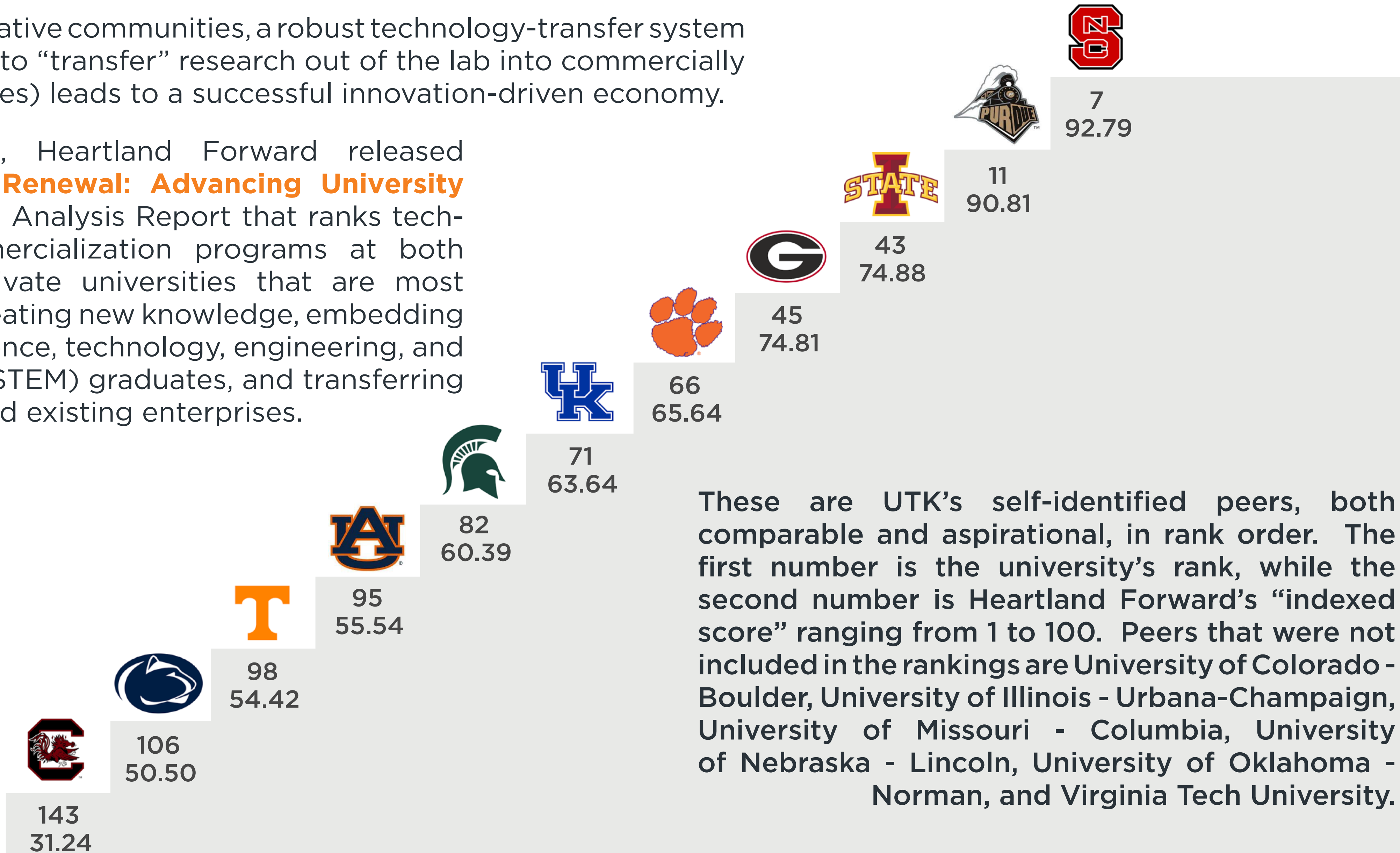
UTK Comparable Peers




UTK Aspirational Peers

For many innovative communities, a robust technology-transfer system (i.e., the ability to “transfer” research out of the lab into commercially viable businesses) leads to a successful innovation-driven economy.

In May 2022, Heartland Forward released **“Research to Renewal: Advancing University Tech Transfer”** Analysis Report that ranks tech-transfer commercialization programs at both public and private universities that are most proficient in creating new knowledge, embedding it into their science, technology, engineering, and mathematics (STEM) graduates, and transferring both to new and existing enterprises.



These are UTK’s self-identified peers, both comparable and aspirational, in rank order. The first number is the university’s rank, while the second number is Heartland Forward’s “indexed score” ranging from 1 to 100. Peers that were not included in the rankings are University of Colorado - Boulder, University of Illinois - Urbana-Champaign, University of Missouri - Columbia, University of Nebraska - Lincoln, University of Oklahoma - Norman, and Virginia Tech University.

An aerial photograph of Knoxville, Tennessee, taken during the "golden hour" of sunset. The sky is a mix of orange, yellow, and soft blue. The city's skyline is visible, including the prominent Sunsphere structure. The foreground shows a mix of urban buildings and greenery.

If the Knoxville area is to fulfill its economic promise, it will need to do so by embracing and being a leader in innovation. Having great assets is no longer enough. The community must utilize its assets in a way that **propels it to economic greatness** and embracing an innovation mindset is the best way to accomplish that.

This report, which will be published every-other-year, is designed to measure Knoxville's innovation progress using a myriad of data and rankings. The goal is for the community to make decisions and take actions that result in it quickly improving the numbers that are identified in this report, thus increasing its economic prosperity.



Appendix 1

Full List of Innovation Industries in Knoxville MSA

Administrative Management & General Management Consulting Services	All Other Telecommunications	Architectural Services
Biomass Electric Power Generation	Computer Facilities Management Services	Computer Systems Design Services
Computing Infrastructure Providers, Data Processing, Web Hosting, & Related Services	Corporate, Subsidiary, & Regional Managing Offices	Custom Computer Programming Services
Electric Bulk Power Transmission & Control	Electric Power Distribution	Engineering Services
Environmental Consulting Services	Geophysical Surveying & Mapping Services	International Affairs
Landscape Architectural Services	Manufacturing and Reproducing Magnetic & Optical Media	Marketing Consulting Services
National Security	Offices of Bank Holding Companies	Offices of Other Holding Companies
Other Computer Related Services	Other Management Consulting Services	Other Scientific & Technical Consulting Services
Process, Physical Distribution, & Logistics Consulting Services	Research & Development in Biotechnology (except Nanobiotechnology)	Research & Development in Nanotechnology
Research & Development in the Physical, Engineering, & Life Sciences (except Nanotechnology and Biotechnology)	Research & Development in the Social Sciences & Humanities	Satellite Telecommunications
Securities & Commodity Exchanges	Software Publishers	Surveying & Mapping (except Geophysical) Services
Testing Laboratories & Services	Web Search Portals & All Other Information Services	

Appendix 2

Full List of Innovation Occupations in Knoxville MSA

Aerospace Engineers	Anthropologists & Archeologists	Architectural & Engineering Managers
Astronomers	Atmospheric & Space Scientists	Biochemists & Biophysicists
Biological Scientists, All Other	Cartographers & Photogrammetrists	Chemical Engineers
Chemists	Commercial & Industrial Designers	Computer & Information Research Scientists
Computer & Information Systems Managers	Computer Hardware Engineers	Computer Network Architects
Computer Network Support Specialists	Computer Occupations, All Other	Computer Programmers
Computer Systems Analysts	Computer User Support Specialists	Conservation Scientists
Data Scientists	Database Administrators	Database Architects
Economists	Electrical Engineers	Electronics Engineers, Except Computer
Engineers, All Other	Environmental Scientists & Specialists, Including Health	Geographers
Geoscientists, Except Hydrologists & Geographers	Graphic Designers	Health & Safety Engineers, Except Mining Safety Engineers & Inspectors
Hydrologists	Industrial Engineers	Information Security Analysts
Life Scientists, All Other	Life, Physical, & Social Science Technicians, All Other	Marine Engineers & Naval Architects
Materials Engineers	Materials Scientists	Mathematical Science Occupations, All Other

Appendix 2 (Continued)

Full List of Innovation Occupations in Knoxville MSA

Mathematicians	Mechanical Engineers	Microbiologists
Mining & Geological Engineers, Including Mining Safety Engineers	Network and Computer Systems Administrators	Nuclear Engineers
Operations Research Analysts	Petroleum Engineers	Physical Scientists, All Other
Physicists	Software Developers	Software Quality Assurance Analysts & Testers
Statisticians	Survey Researchers	Web and Digital Interface Designers
Web Developers		





KNOXVILLE CHAMBER

The Knoxville Chamber fulfills its mission of driving regional economic prosperity by creating a vibrant, innovative ecosystem for the entire Knoxville region.

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www.knoxvillechamber.com

