



# TECH 2022 INNOVATION INDEX

National Metro Comparison

TECH WORKER SUPPLY + TECH WORKER DEMAND + INNOVATION

# NC TECH METRO INDEX

## METHODOLOGY

This year's tech metro index follows the same methodology created for the first iteration in 2021. Economic Leadership LLC reviewed the data available at the metropolitan statistical area (MSA) level relevant to the tech sector to create a list of metrics to evaluate. This list of potential metrics was presented to NC TECH's board of advisors who provided feedback to finalize the list. The list of metrics was grouped into three subindexes of tech talent supply, tech talent demand, and innovation. Based on feedback from the tech business leaders on the board, supply of tech workers was given the highest weighting, as they felt it was one of the biggest factors in a tech business' location decision. Demand was the next priority, as colocation has been a big factor in tech agglomeration. Innovation was given the lower weighting, as the metrics available at the metro level were more focused on general research & development (R&D) and entrepreneurship, rather than specifically tech focused data.

## INTRODUCTION

NC TECH has been quantifying the state's progress in the tech industry for years. In early 2023, the organization will release the ninth version of the State of the Tech Industry (STIR) report, which analyzes the size and growth of the state's tech workers, firms, and wages. A key component of the STIR report is comparing North Carolina with the other states to gauge performance and assess competitiveness. The STIR report is produced annually by Economic Leadership LLC, a research and consulting firm also based in North Carolina.

In 2021, NC TECH wanted to develop a way to evaluate the metro areas of the state (STIR focuses on the state level) and asked Economic Leadership LLC to help develop an index to compare the state's metros' tech performance against other top metros in the country. A methodology for measuring metro tech performance was developed with the goal to release new findings annually. This report details the results from the second year of the analysis for release in the fall of 2022.

The metro index focuses on emerging challenges for tech hubs, including a heavy focus on 2022's top competitive issue, the availability of workforce. The struggle to find enough qualified workers has been exacerbated since the onset of the COVID-19 pandemic. The index also places an equal emphasis on tech skills and traditional, educational training. As skills-based hiring is rising as a trend to find talent, this index includes data on job postings and online profiles based on whether they contain tech skills, regardless of educational attainment. The methodology assesses postsecondary education talent but also quantifies those who may have the necessary skills without institutional training. Self-employed tech workers were also included in this analysis to capture all available tech talent in an area.



## THE NC TECH METRO INDEX WEIGHTING

Each subindex consisted of seven unique metrics that were weighted equally (14.3 percent) based on their ranking. Most of the data evaluated is from the year 2021 or 2022. Some of the most recent data from public governmental sources is a few years older. Three metrics

did not have new data for this year's report (STEM education, patents, and business dynamism) and the same data from the previous metro index was used. A more detailed description of each metric is provided in the appendix.

### TECH SUPPLY: 45%

	SOURCE	DATA YEAR
Resident tech workers per 1,000 adults	Lightcast	2021
Computer, math, and statistics degrees per 1,000 adults	Census	2020
STEM educational completions per 1,000 adults	Lightcast	2020
Number of online profiles in MSA with tech skills per 1,000 adults	Lightcast	2018-2022
Bachelor's degree or higher per 1,000 adults	Lightcast	2021
H-1B visa approvals per 1,000 adults	USCIS	2018-2021
Diversity of tech occupations relative to total population	Lightcast	2021

### TECH DEMAND: 35%

Tech occupation location quotient (LQ)	Lightcast	2021
Unique job postings with tech skills per 1,000 adults	Lightcast	2018-2022
Median job posting duration	Lightcast	2018-2022
Cost of living adjusted tech wages	Lightcast	2021
Annual tech job openings per 1,000 adults	Lightcast	2018-2022
Competitive effect of tech job growth	Lightcast	2018-2022
Turnover rate of employees	Lightcast	2021

### INNOVATION: 20%

Patents per 1,000 workers	US PATENT OFFICE	2019
Higher education R&D as % of gross area product	NSF	2020
Business funded higher education R&D as a % of gross area product	NSF	2020
SBIR/STTR funding per \$ of gross area product	SBIR	2020
Business dynamism rate (opening vs closing Rate)	Census	2019
Business applications per 1,000 adults	Census	2021
Business R&D as a % of gross area product	NSF	2019

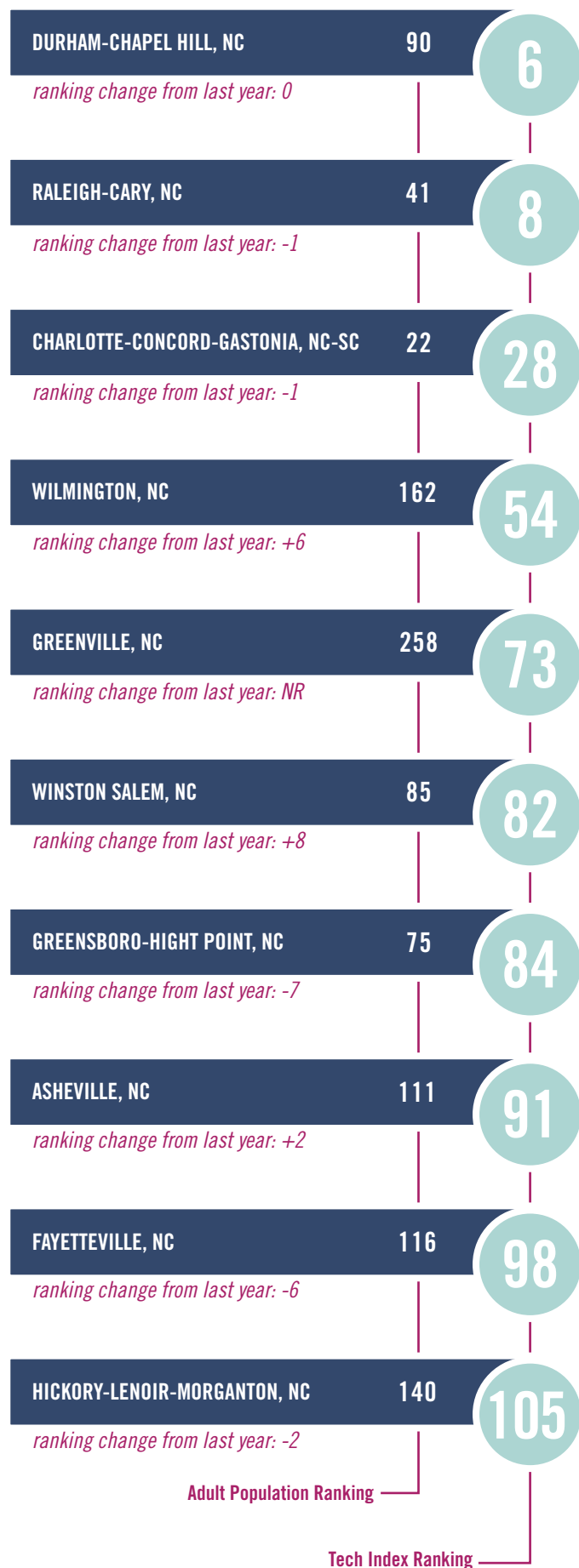
An index value was created for each subindex and then based on its weighting a final overall index was created. This index included the top 105 populated MSAs in America as well as the top ten populated metros in NC. Some of the NC metros were included in the 105 most populated MSAs. The addition of five North Carolina metros that were smaller than those in the 105 most populous created a total of 110 metros to be ranked. Data was also standardized by the adult population (those over age 25 in each MSA), or the gross area product of the metro's economy.

# OVERALL RESULTS

With the tech supply, tech demand, and innovation indexes combined, the final results included Charlotte, Raleigh, and Durham in the top 30 best ranked tech metros once again this year. With Durham-Chapel Hill and Raleigh-Cary both in the top ten at 6th and 8th respectively. Notable were gains in other metros in the state, Winston-Salem and Wilmington improved 6 and 8 spots respectively in the rankings this year.

Interestingly, several of the smaller metros in the state that fall outside of the top 105 metros in terms of population performed well. Considering that Greenville's 2021 adult population ranked the metro 258th out of all MSAs in the nation, it is quite impressive that the metro ranked as the 73rd best metro for tech. Many of the typical tech metro rankings across the country only look at the top 50 or 100 metros so many of these smaller metros in NC had not been typically compared to other metros across the country prior to this research.

## NORTH CAROLINA STANDINGS



# FINAL OVERALL TECH METRO INDEX RANKINGS

In last year's analysis, Seattle came out on top as the number one tech metro. This year Seattle dropped back to the 5th spot and Austin moved up two spots to number one in 2022. The rest of the top five metros for tech include the Silicon Valley metros and Boston. The San Diego metro moved up six spots to get into the top ten in this year's analysis. The Charlotte metro ranked just ahead of the Chicago area.

Austin-Round Rock-Georgetown, TX  
San Jose-Sunnyvale-Santa Clara, CA  
San Francisco-Oakland-Berkeley, CA  
Boston-Cambridge-Newton, MA-NH  
Seattle-Tacoma-Bellevue, WA  
**Durham-Chapel Hill, NC** 6  
San Diego-Chula Vista-Carlsbad, CA  
**Raleigh-Cary, NC** 8  
Washington-Arlington-Alexandria, DC-VA-MD-WV  
Minneapolis-St. Paul-Bloomington, MN-WI  
Salt Lake City, UT  
Provo-Orem, UT  
Madison, WI  
Columbus, OH  
Baltimore-Columbia-Towson, MD  
Denver-Aurora-Lakewood, CO  
Dallas-Fort Worth-Arlington, TX  
Portland-Vancouver-Hillsboro, OR-WA  
Atlanta-Sandy Springs-Alpharetta, GA  
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD  
New York-Newark-Jersey City, NY-NJ-PA  
Fayetteville-Springdale-Rogers, AR  
Hartford-East Hartford-Middletown, CT  
Pittsburgh, PA  
Worcester, MA-CT  
Phoenix-Mesa-Chandler, AZ  
Albany-Schenectady-Troy, NY  
**Charlotte-Concord-Gastonia, NC-SC** 28  
Chicago-Naperville-Elgin, IL-IN-WI  
St. Louis, MO-IL  
Colorado Springs, CO  
Sacramento-Roseville-Folsom, CA  
Palm Bay-Melbourne-Titusville, FL  
Nashville-Davidson-Murfreesboro-Franklin, TN  
Richmond, VA  
Omaha-Council Bluffs, NE-IA  
Cincinnati, OH-KY-IN

Boise City, ID  
Detroit-Warren-Dearborn, MI  
Des Moines-West Des Moines, IA  
Rochester, NY  
Los Angeles-Long Beach-Anaheim, CA  
Dayton-Kettering, OH  
Kansas City, MO-KS  
Milwaukee-Waukesha, WI  
Tucson, AZ  
Indianapolis-Carmel-Anderson, IN  
Houston-The Woodlands-Sugar Land, TX  
Tampa-St. Petersburg-Clearwater, FL  
Bridgeport-Stamford-Norwalk, CT  
Cleveland-Elyria, OH  
Harrisburg-Carlisle, PA  
Orlando-Kissimmee-Sanford, FL  
**Wilmington, NC** 54  
Charleston-North Charleston, SC  
Lexington-Fayette, KY  
Albuquerque, NM  
Akron, OH  
Oxnard-Thousand Oaks-Ventura, CA  
Birmingham-Hoover, AL  
San Antonio-New Braunfels, TX  
Virginia Beach-Norfolk-Newport News, VA-NC  
Syracuse, NY  
Buffalo-Cheektowaga, NY  
Ogden-Clearfield, UT  
Providence-Warwick, RI-MA  
New Haven-Milford, CT  
Jacksonville, FL  
Knoxville, TN  
Springfield, MA  
Oklahoma City, OK  
Portland-South Portland, ME  
**Greenville, NC** 73  
Little Rock-North Little Rock-Conway, AR

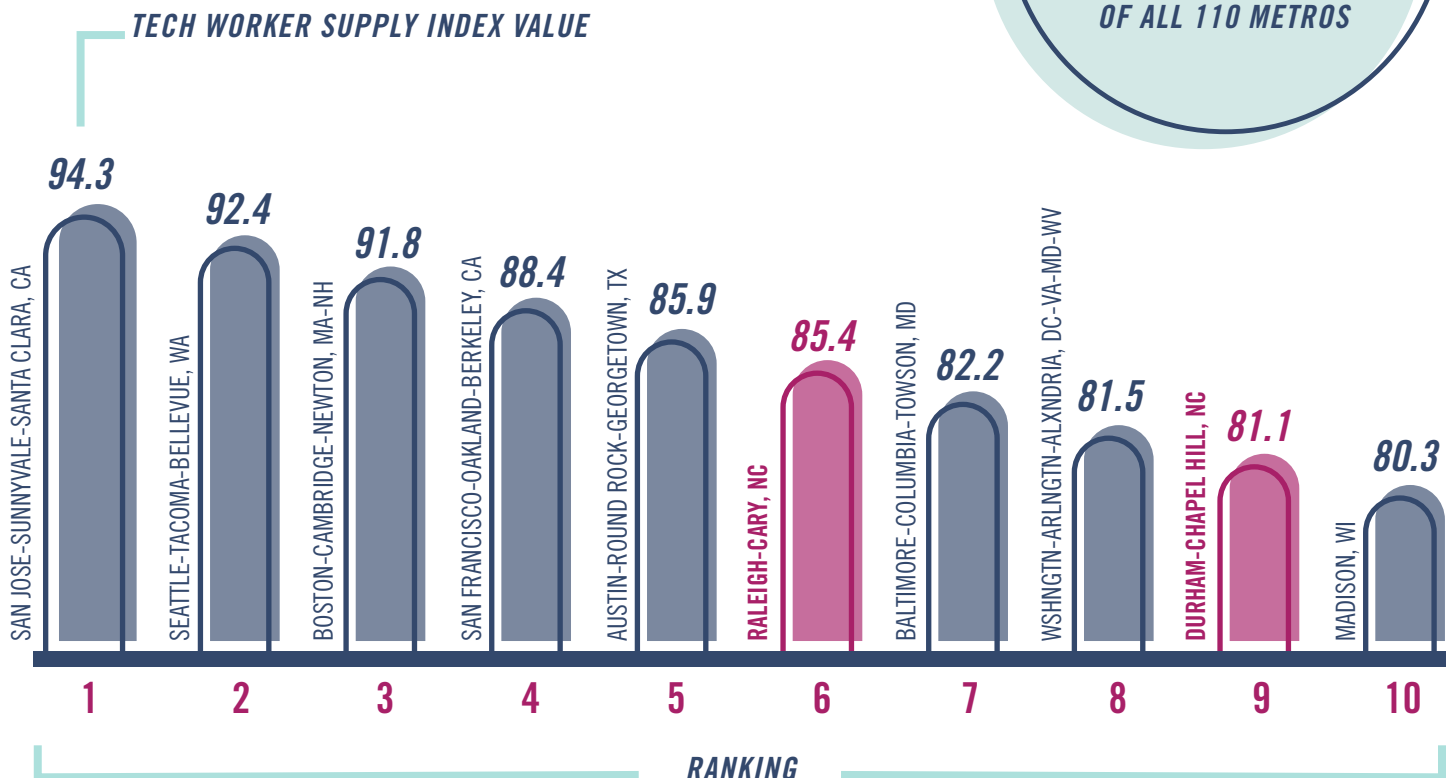
Grand Rapids-Kentwood, MI  
Wichita, KS  
Poughkeepsie-Newburgh-Middletown, NY  
Greenville-Anderson, SC  
Louisville/Jefferson County, KY-IN  
Miami-Fort Lauderdale-Pompano Beach, FL  
Spokane-Spokane Valley, WA  
**Winston-Salem, NC** 82  
Urban Honolulu, HI  
**Greensboro-High Point, NC** 84  
Chattanooga, TN-GA  
Allentown-Bethlehem-Easton, PA-NJ  
Columbia, SC  
Memphis, TN-MS-AR  
Deltona-Daytona Beach-Ormond Beach, FL  
Toledo, OH  
**Asheville, NC** 91  
North Port-Sarasota-Bradenton, FL  
Baton Rouge, LA  
Las Vegas-Henderson-Paradise, NV  
Tulsa, OK  
Augusta-Richmond County, GA-SC  
New Orleans-Metairie, LA  
**Fayetteville, NC** 98  
El Paso, TX  
Youngstown-Warren-Boardman, OH-PA  
McAllen-Edinburg-Mission, TX  
Lakeland-Winter Haven, FL  
Myrtle Beach-Conway-N. Myrtle Beach, SC-NC  
Riverside-San Bernardino-Ontario, CA  
**Hickory-Lenoir-Morganton, NC** 105  
Fresno, CA  
Jackson, MS  
Scranton--Wilkes-Barre, PA  
Stockton, CA  
Bakersfield, CA

NO.1

# TECH WORKER SUPPLY INDEX

The Tech Worker Supply subindex was given the highest weighting (45 percent) out of the three. This was based on feedback provided by NC TECH's board of advisors, who stated that the availability of workforce was the greatest challenge for tech companies, and the biggest draw that a tech hub could provide. This index included the metrics of the number of tech workers who live in the metro, the number of computer and math degrees present, and tech skills present in the population. The ability of the metro to accept high skilled workers from abroad, and the diversity of the tech sector, were also included in evaluating the supply of tech workers.

## TOP 10 METROS FOR TECH WORKER SUPPLY



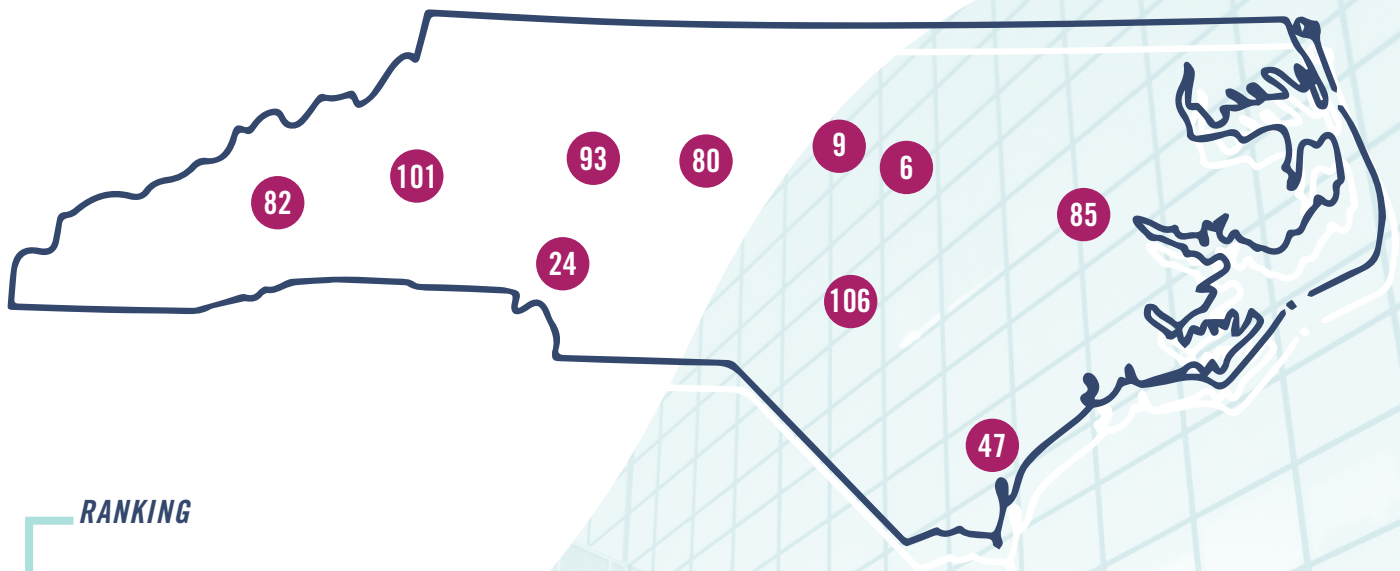
# 6 & 9

RALEIGH-CARY AND  
DURHAM-CHAPEL HILL  
RANK 6<sup>TH</sup> AND 9<sup>TH</sup> OUT  
OF ALL 110 METROS



# TOP 10 NC METROS

Raleigh-Cary, NC ranked sixth of the 110 metros for tech talent supply up two spots from the previous year, and just behind Austin. Durham-Chapel Hill, NC moved into the top ten (9th) this year after ranking just outside of the top ten at 11th in 2021. Raleigh-Cary scored in the top ten for every supply metric except H1-B visa approvals and tech worker diversity. Charlotte ranked in the top 20 for online profiles with tech skills, indicating that when looking at skills, the metro has more tech talent than the educational data suggests. Greenville, NC had the highest value of STEM education completions per capita across all 110 metros. Durham had the 2nd highest rate of H-1B visas just behind the San Jose metro.



RANKING

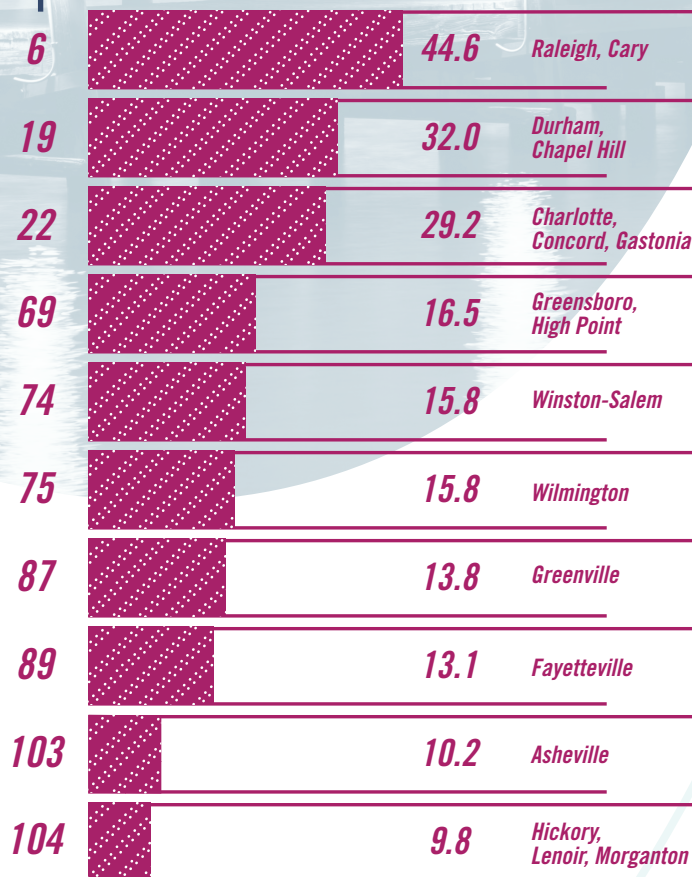
6	RALEIGH-CARY, NC.....	85.4	82	ASHEVILLE, NC.....	36.3
9	DURHAM-CHAPEL HILL, NC.....	81.1	85	GREENVILLE, NC.....	35.5
24	CHARLOTTE-CONCORD-GASTONIA, NC-SC.....	68.6	93	WINSTON-SALEM, NC.....	27.6
47	WILMINGTON, NC.....	55.0	101	HICKORY-LENOIR-MORGANTON, NC.....	19.4
80	GREENSBORO-HIGH POINT, NC.....	37.1	106	FAYETTEVILLE, NC.....	14.7

TECH WORKER SUPPLY INDEX VALUE

# NC TECH WORKER SUPPLY INDEX CHARTS

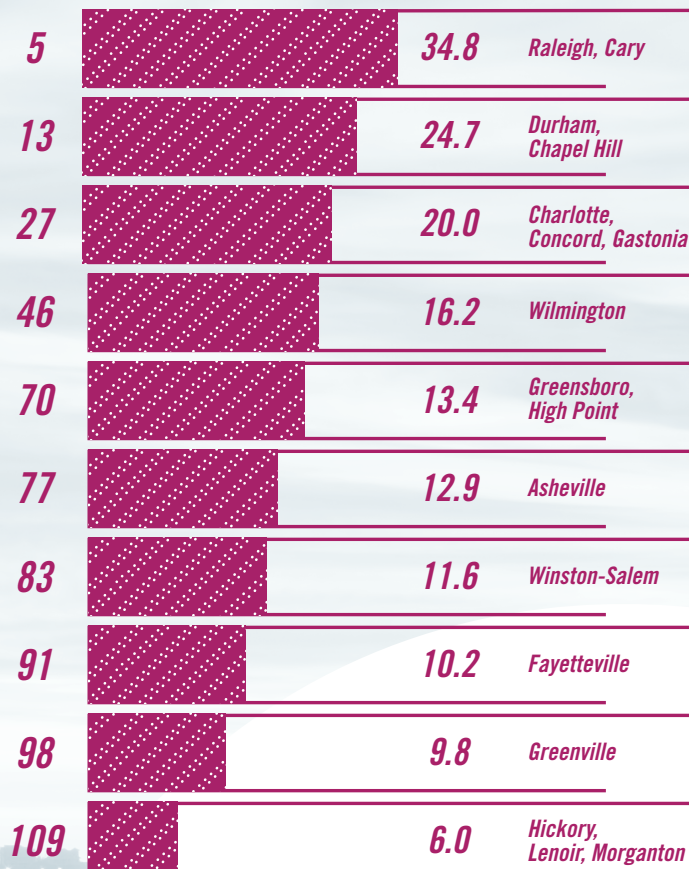
RANKING ACROSS ALL METROS

NUMBER OF RESIDENT TECH WORKERS\*



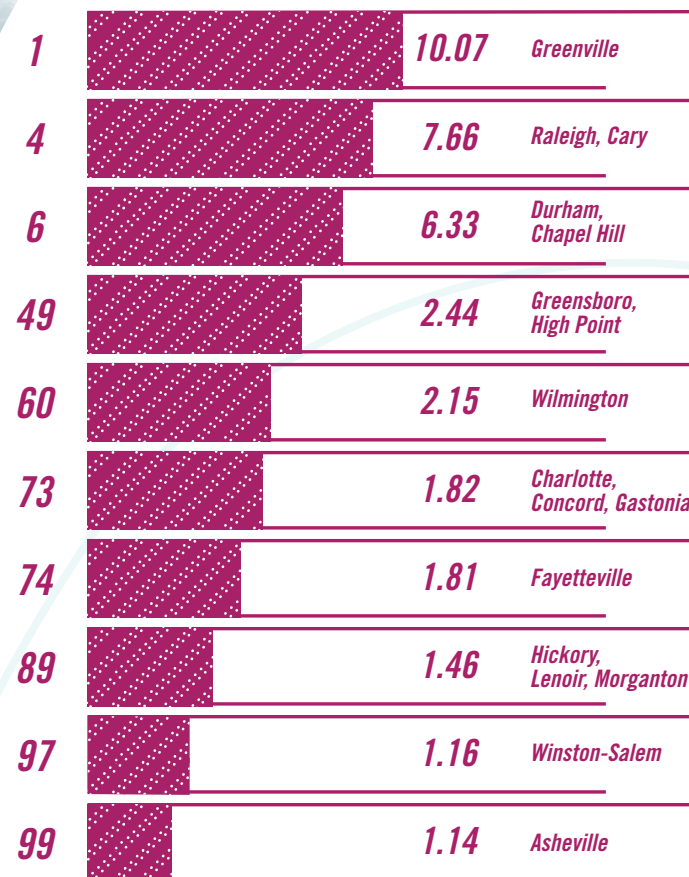
\*PER 1,000 ADULTS

COMPUTER, MATH & STATISTICS DEGREES\*



\*PER 1,000 ADULTS

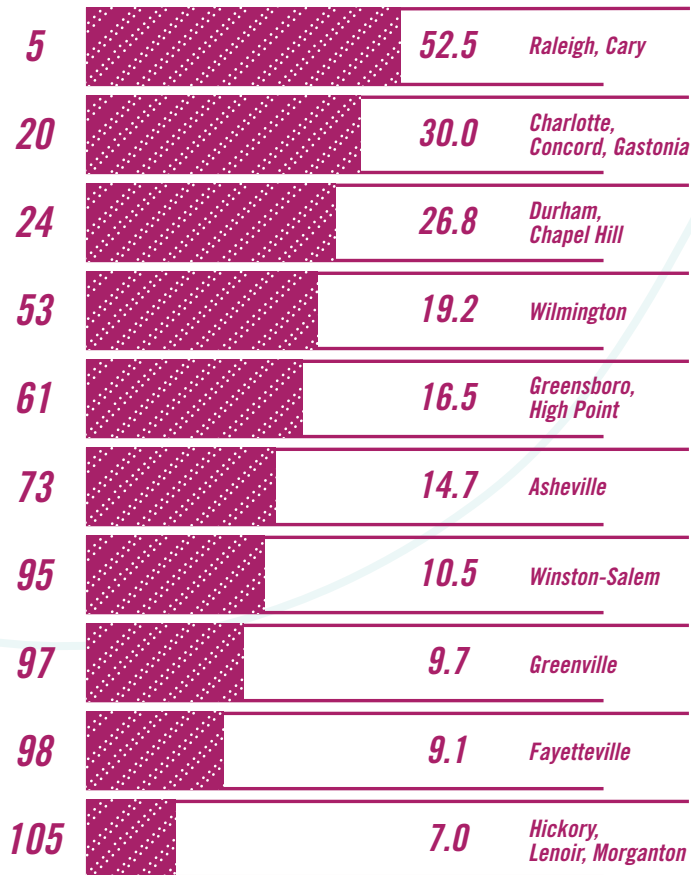
STEM EDUCATIONAL COMPLETIONS\*



\*PER 1,000 ADULTS

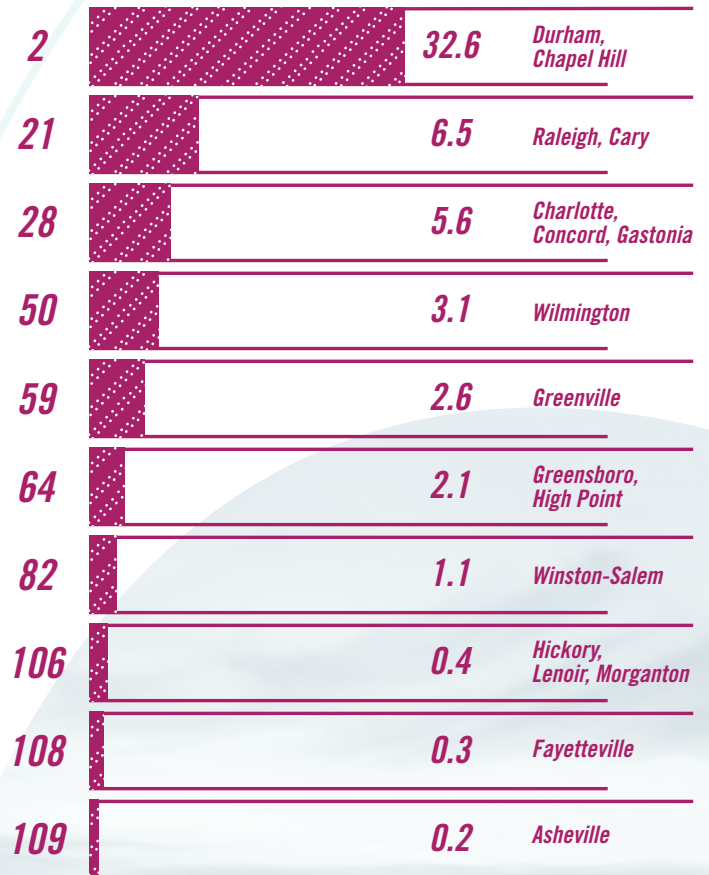


#### NUMBER OF ONLINE PROFILES W/ TECH SKILL(S)\*



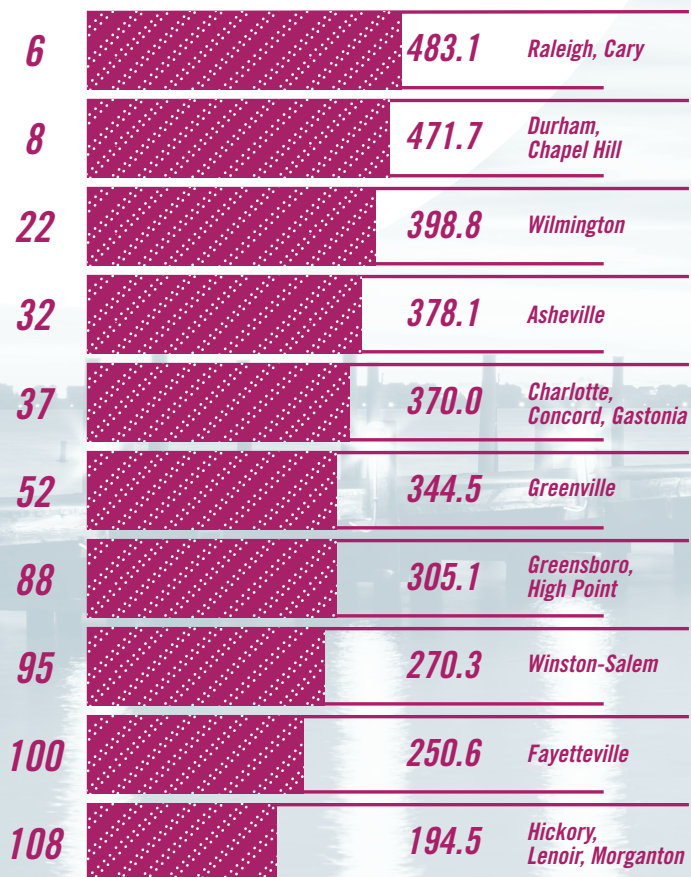
\*PER 1,000 ADULTS

#### H-1B VISA APPROVALS\*



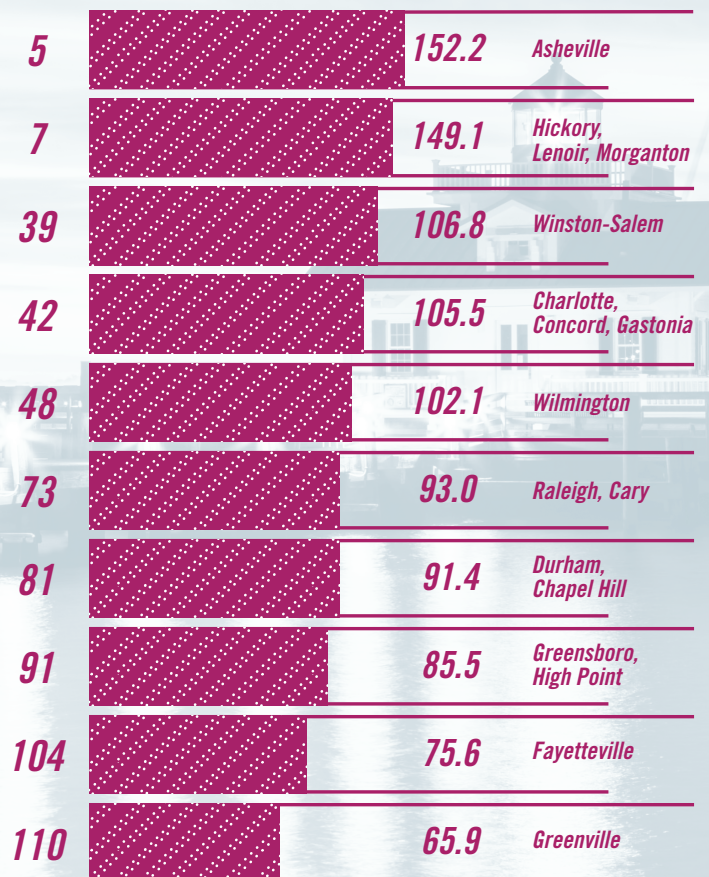
\*PER 1,000 ADULTS

#### PEOPLE W/ BACHELOR'S DEGREES OR HIGHER\*



\*PER 1,000 ADULTS

#### TECH WORKER DIVERSITY INDEX





NO.2

# TECH WORKER DEMAND INDEX

The Tech Worker Demand subindex was given the second highest weighting (35 percent) of the three.

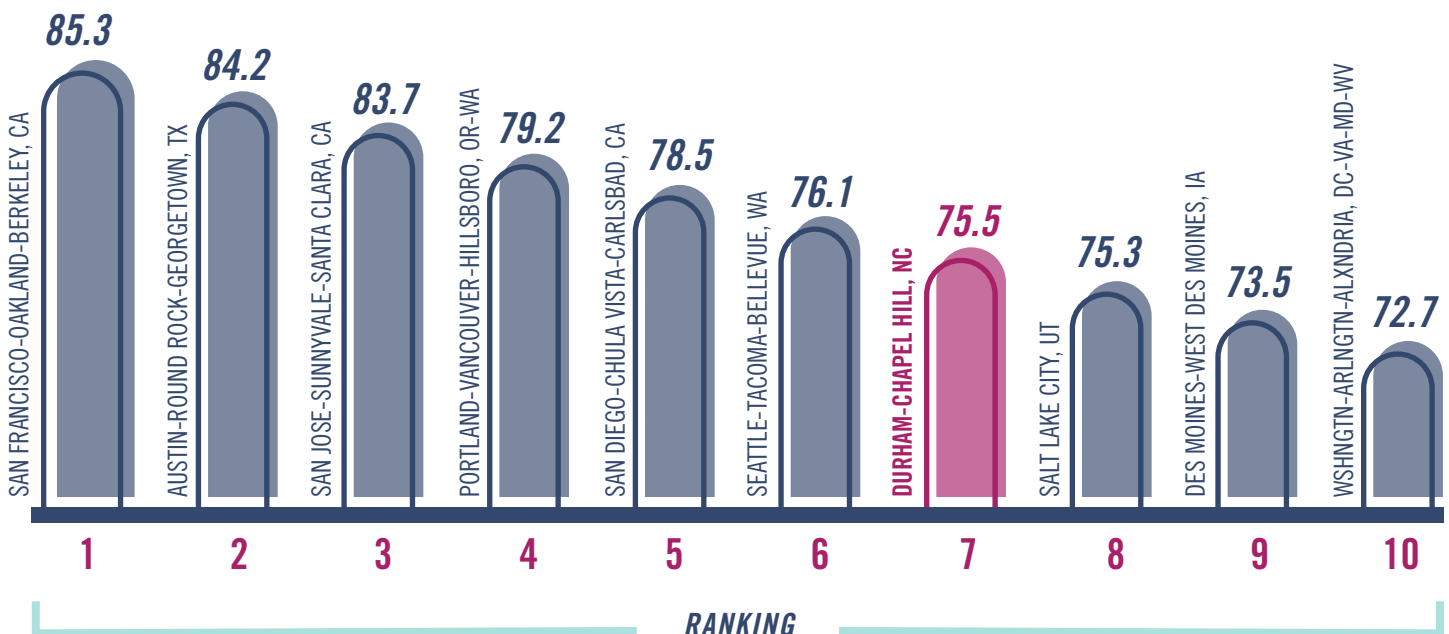
Demand is an important indicator for tech because tech companies and startups look for thriving tech presence when they decide where they want to locate. This index includes the metrics of tech worker concentration, tech wages, and turnover rate. Skills based data was used for measuring demand in job postings.

## TOP 10 METROS FOR TECH WORKER DEMAND

7

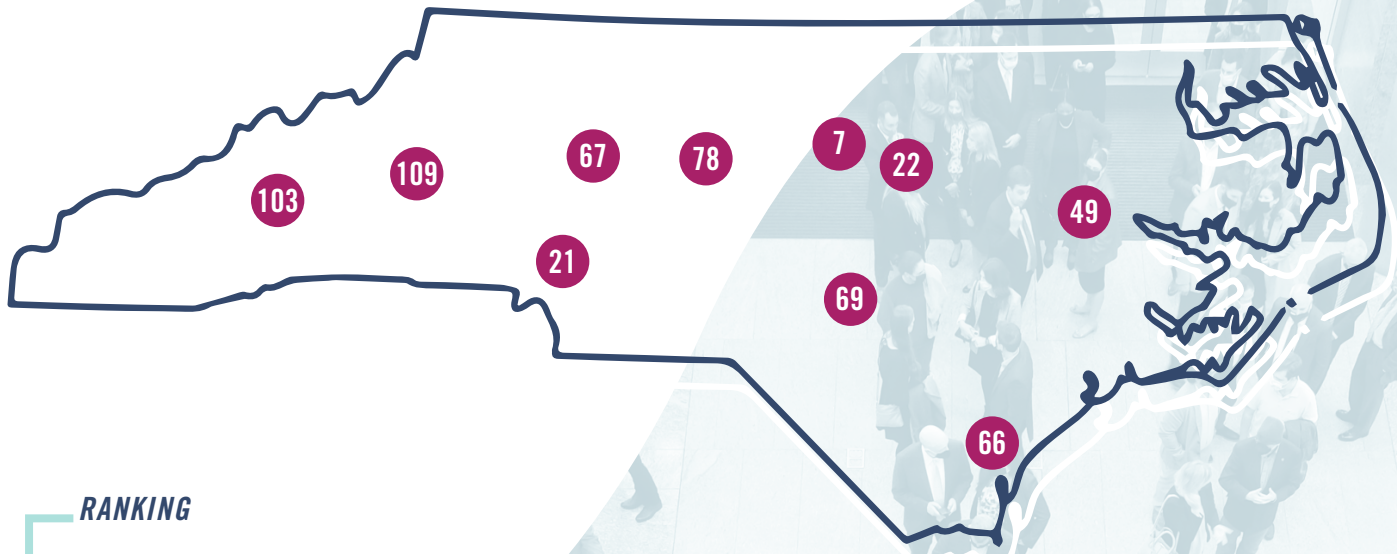
**DURHAM-CHAPEL  
HILL, NC RANKED 7<sup>TH</sup>  
OF THE 110 METROS  
FOR TECH TALENT  
DEMAND**

TECH WORKER DEMAND INDEX VALUE



# TOP 10 NC METROS

Durham-Chapel Hill, NC ranked seventh of the 110 metros for tech demand, up two places from last year and just behind Seattle, WA. The Charlotte and Raleigh metros scored in the top 25. Eight of the ten NC metros scored in the top 50 on cost-of-living adjusted tech wages. The metros in NC tended to have more worker churn, or turnover, in the tech workforce compared to other places in the country.



RANKING

7	DURHAM-CHAPEL HILL, NC.....	75.5	67	WINSTON SALEM, NC.....	44.9
21	CHARLOTTE-CONCORD-GASTONIA, NC-SC.....	64.9	69	FAYETTEVILLE, NC.....	43.7
22	RALEIGH-CARY, NC.....	64.7	78	GREENSBORO-HIGH POINT, NC....	38.7
49	GREENVILLE, NC.....	51.7	103	ASHEVILLE, NC.....	24.2
66	WILMINGTON, NC.....	45.0	109	HICKORY-LENOIR-MORGANTON, NC.....	19.6

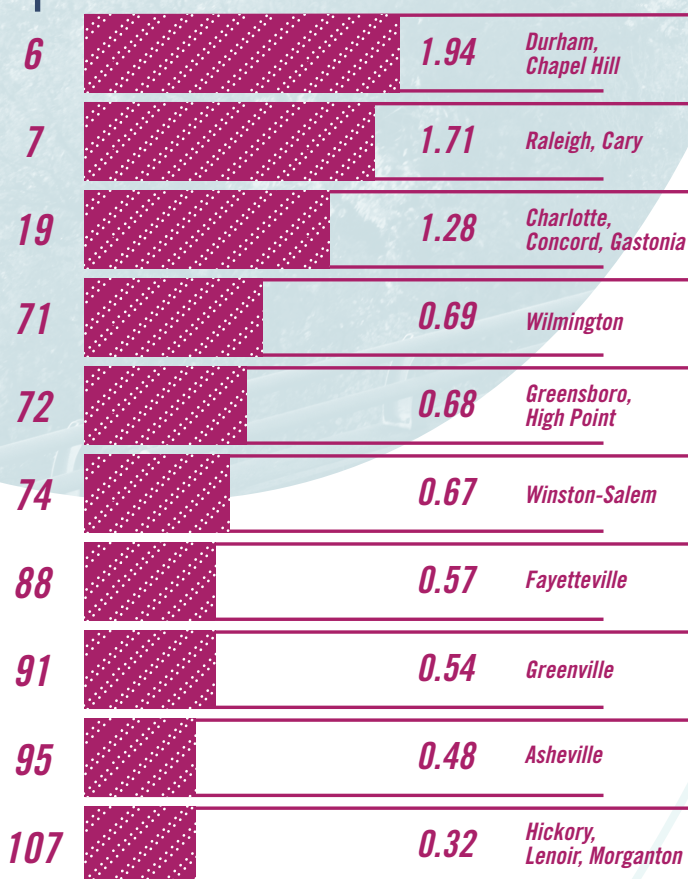
TECH WORKER DEMAND INDEX VALUE



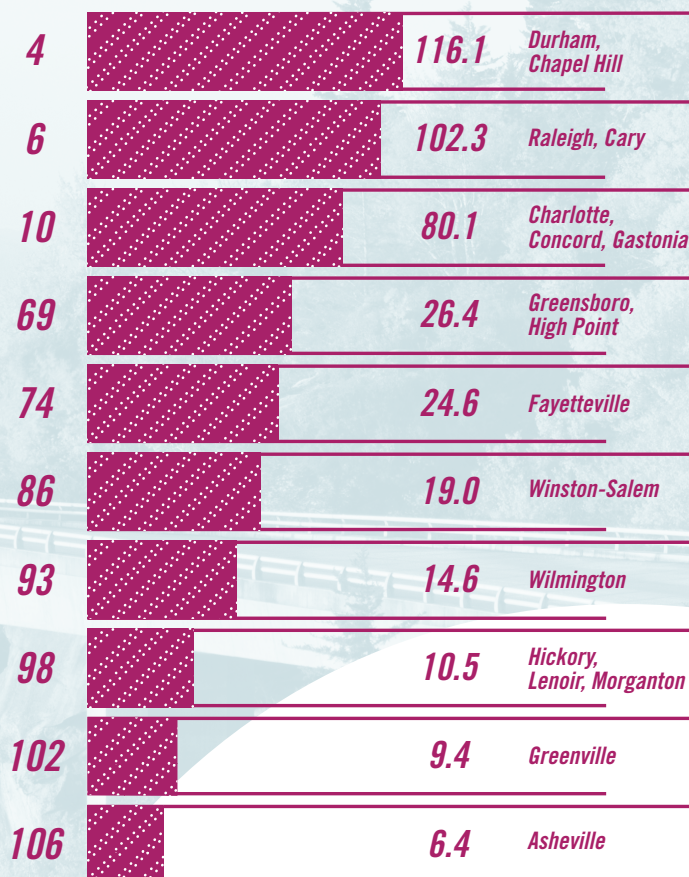
# NC TECH WORKER DEMAND INDEX CHARTS

RANKING ACROSS ALL METROS

## TECH WORKER LOCATION QUOTIENT

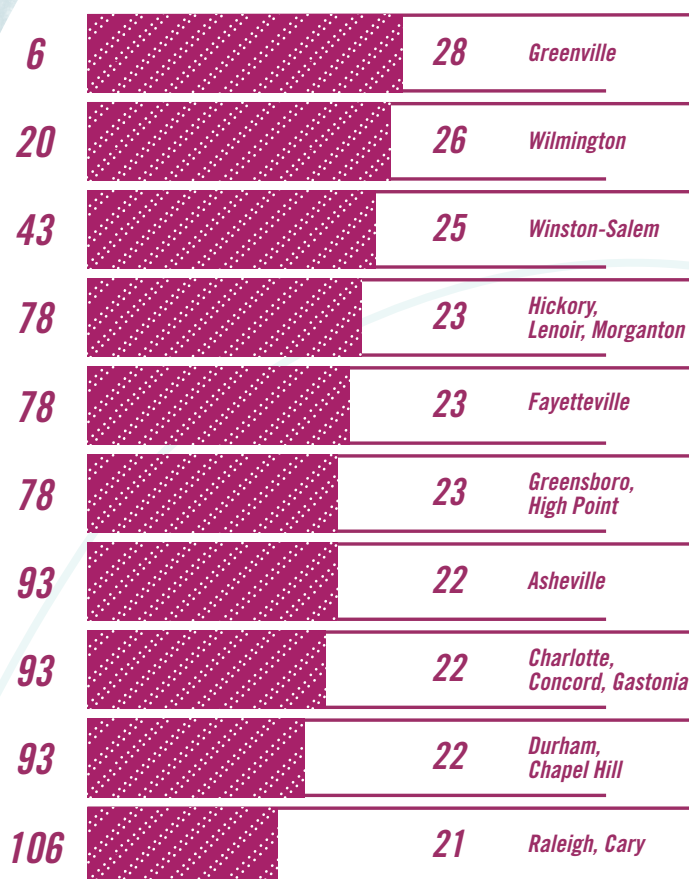


## UNIQUE JOB POSTINGS W/ TECH SKILL(S)\*



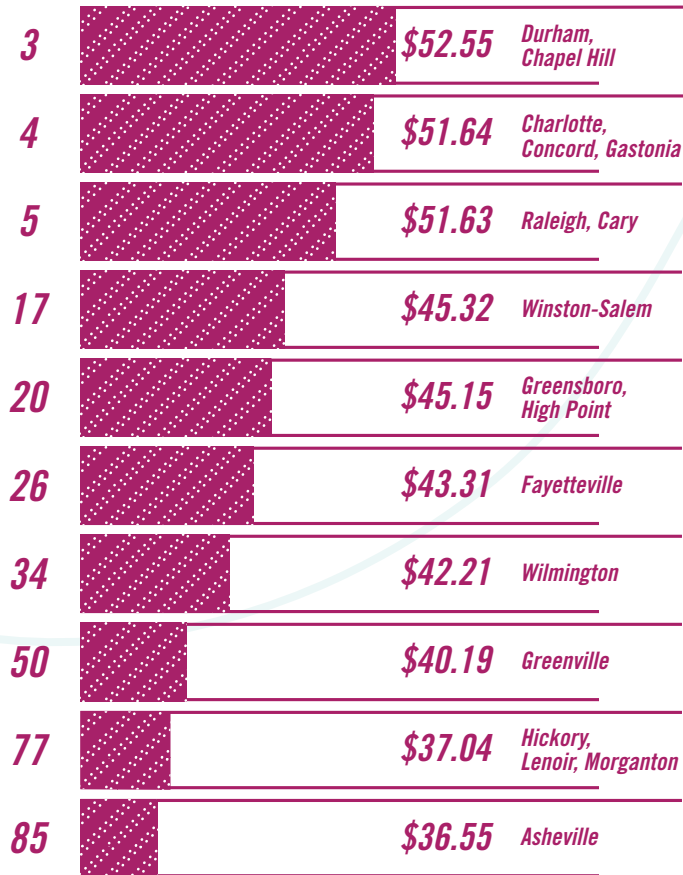
\*PER 1,000 ADULTS

## MEDIAN JOB POSTING W/ TECH SKILL(S) DURATION, DAYS

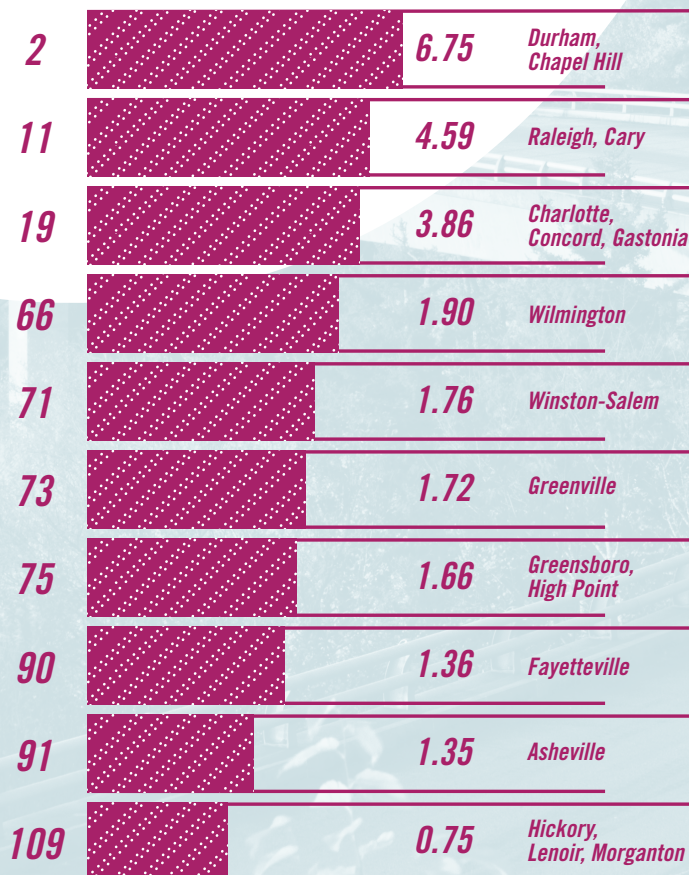




### COST OF LIVING ADJUSTED MEDIAN HOURLY TECH WAGES

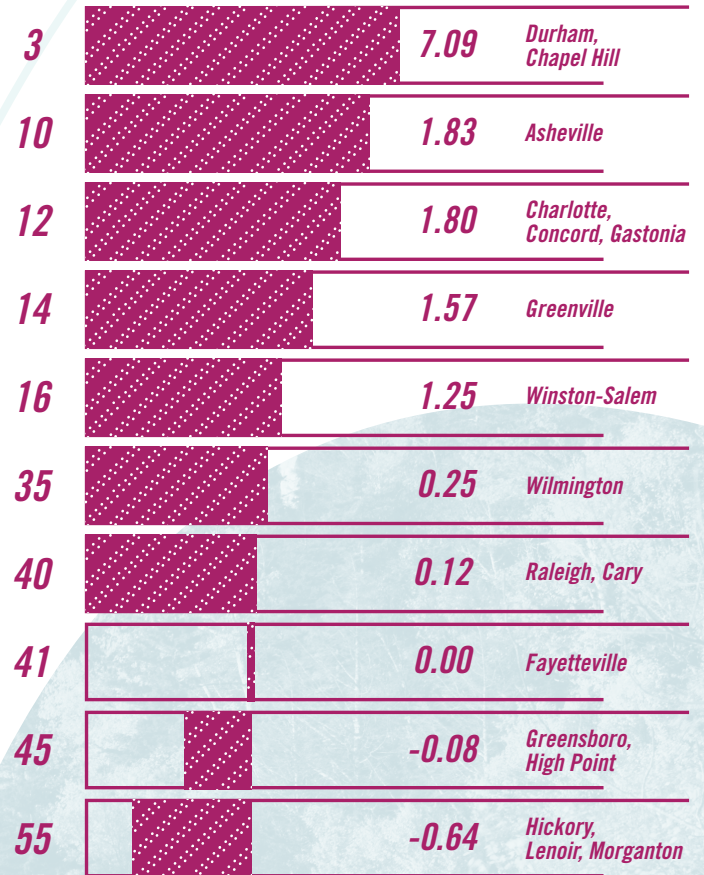


### ANNUAL TECH JOB OPENINGS\*



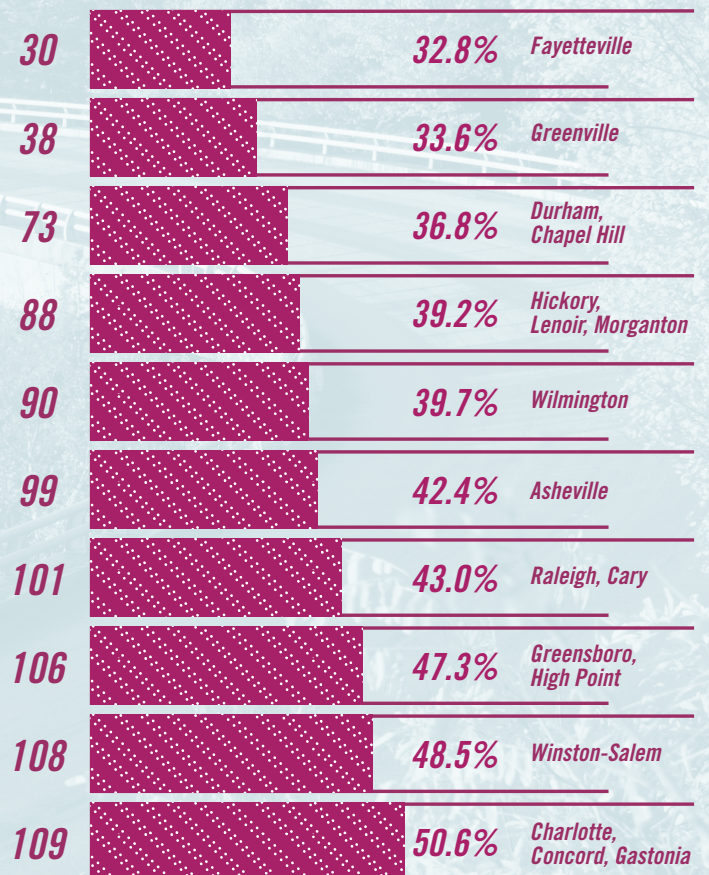
\*PER 1,000 ADULTS

### COMPETITIVE EFFECT OF TECH JOB GROWTH\*



\*PER 1,000 ADULTS

### TURNOVER RATES OF TECH WORKERS



NO.3

# TECH INNOVATION INDEX

The Tech Innovation subindex evaluates the culture of R&D and entrepreneurship in each metro.

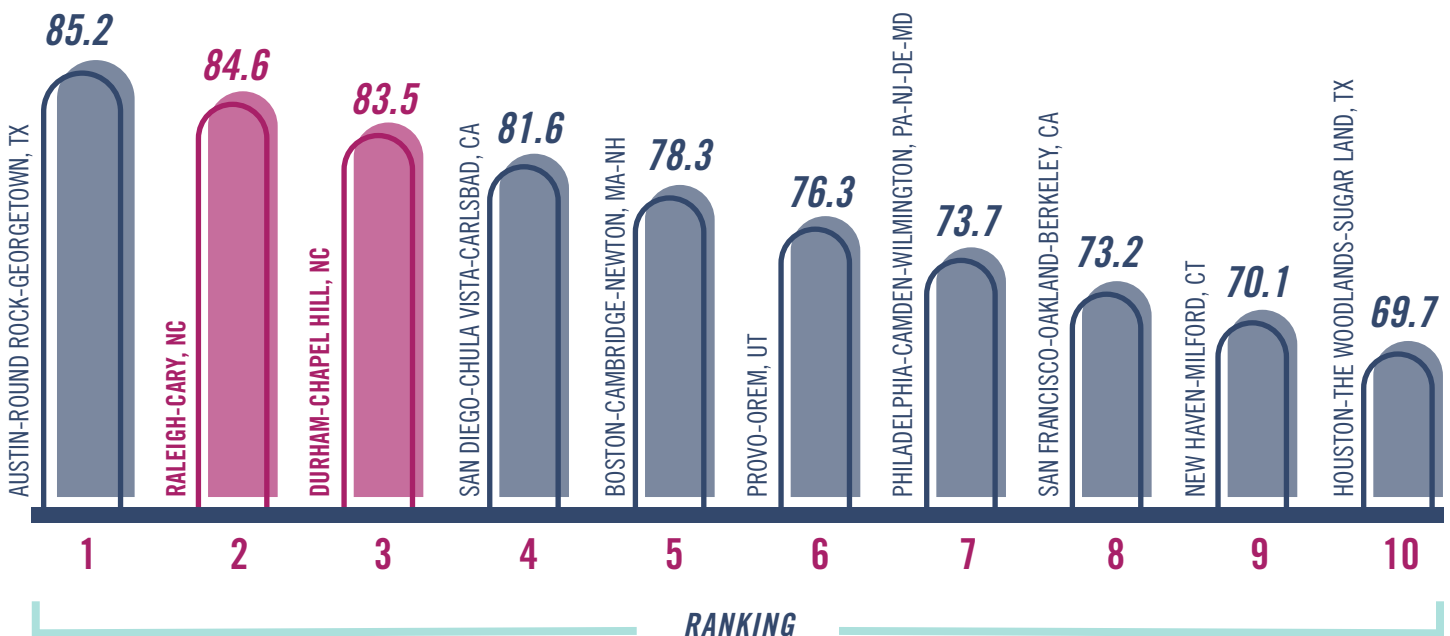
Our industry partners reminded the researchers that the next great tech advancements will come in non-tech industries such as automobiles, healthcare, etc. Therefore research & development is important to developing new and innovative technology. Some of the biggest unicorns of the past decade have been tech startups. If a metro can support new businesses and help them thrive, then perhaps the next great tech startup will come out of their area.

## TOP 10 METROS FOR INNOVATION

# 2 & 3

*RALEIGH-CARY AND  
DURHAM-CHAPEL HILL  
RANK 2<sup>ND</sup> AND 3<sup>RD</sup> OUT  
OF ALL 110 METROS*

TECH INNOVATION INDEX VALUE

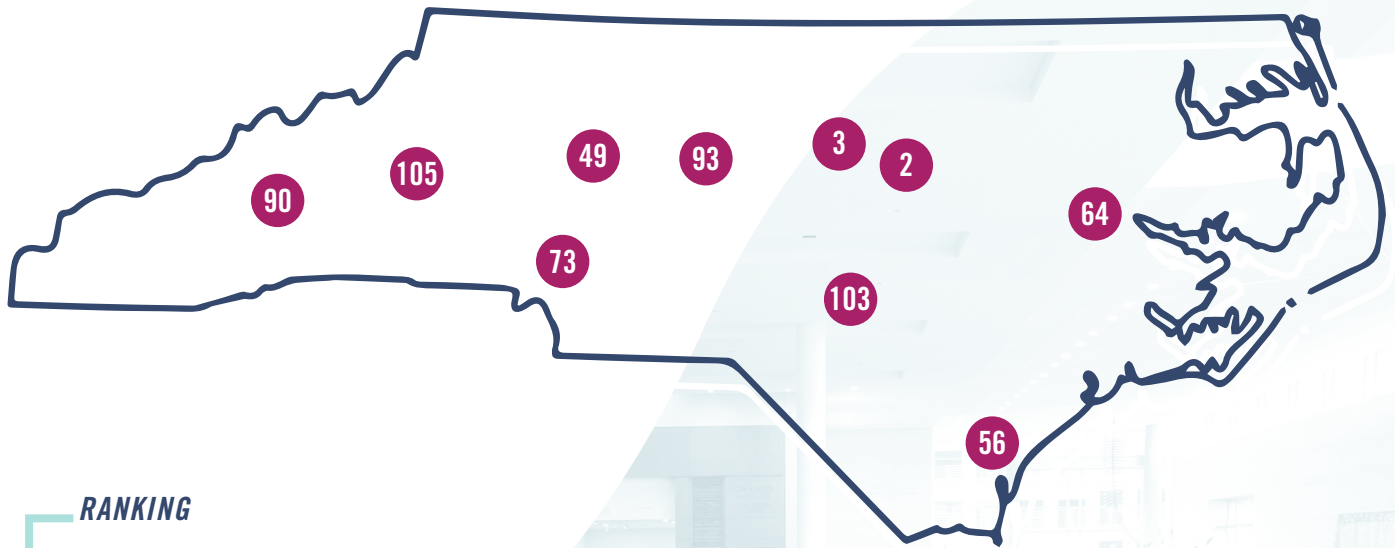




# TOP 10 NC METROS

Raleigh-Cary and Durham-Chapel Hill rank 2nd and 3rd respectively out of all 110 metros studied, just behind Austin, TX for the most innovative tech metro. These rankings are the same as the previous year's results. Durham is notably the top metro out of the 110 metros for rates of R&D dollars.

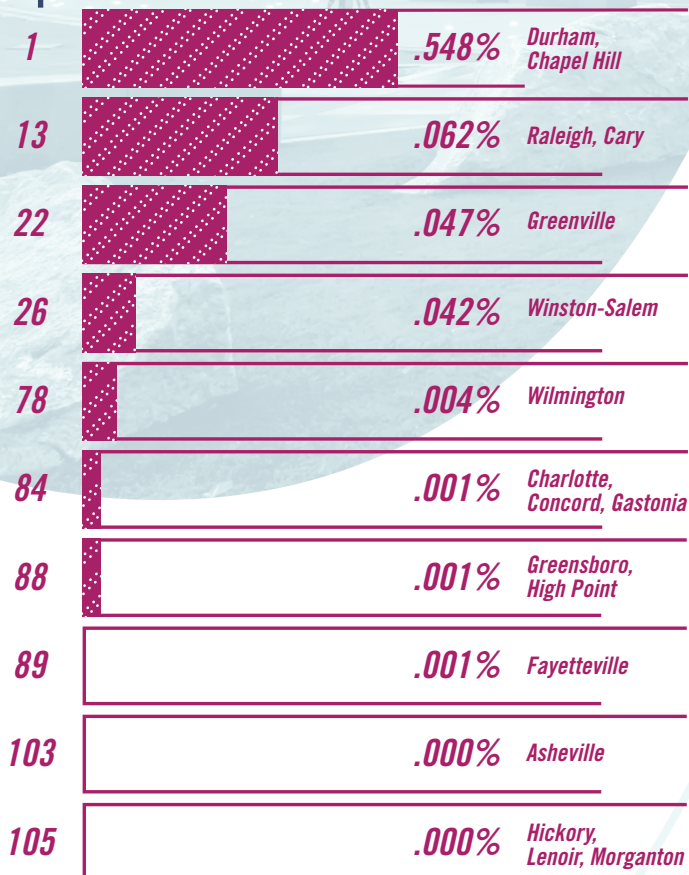
The other metros in North Carolina did not fare as well in innovation as they did in other subindexes. Charlotte did rank 9th overall in business dynamism, meaning more businesses were opening than closing. The innovation subindex is where Charlotte metro scored lower than expected, given its size.



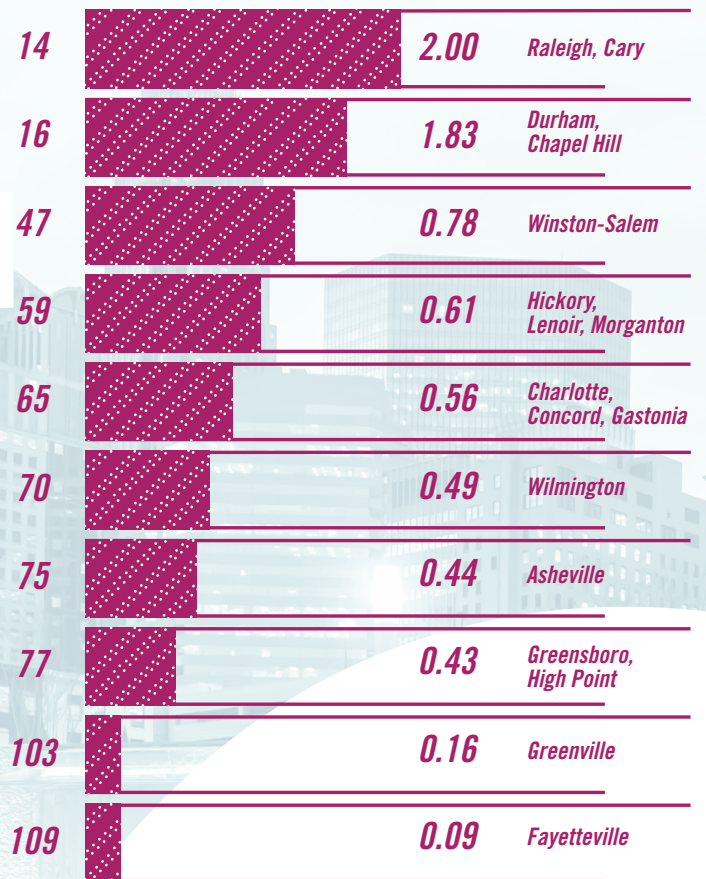
TECH INNOVATION INDEX VALUE

# NC TECH INNOVATION INDEX CHARTS

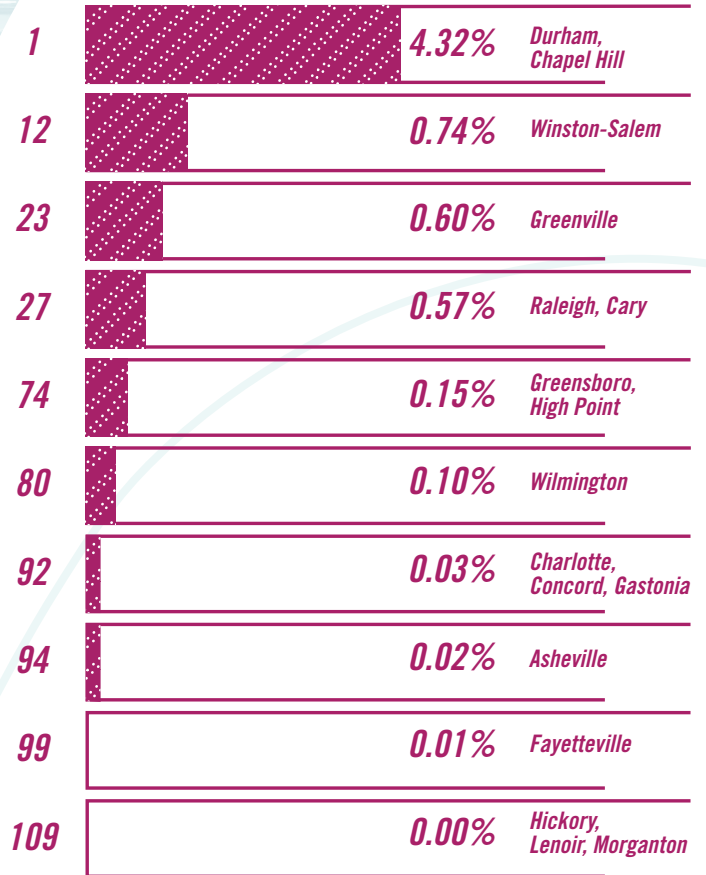
RANKING ACROSS ALL METROS  
BUSINESS  
FUNDED HIGHER ED R&D AS A % OF GROSS AREA PRODUCT



PATENTS PER 1,000 WORKERS



HIGHER ED R&D AS A % OF GROSS AREA PRODUCT





**SBIR/STTR\* FUNDING PER \$1M OF GROSS AREA PRODUCT**

1		\$1,544	Durham, Chapel Hill
15		\$345	Raleigh, Cary
33		\$200	Hickory, Lenoir, Morganton
52		\$104	Winston-Salem
67		\$68	Wilmington
96		\$13	Charlotte, Concord, Gastonia
101		\$0	Asheville
101		\$0	Fayetteville
101		\$0	Greensboro, High Point
101		\$0	Greenville

\*Small Business Innovation Research/Small Business Technology Transfer

**BUSINESS APPLICATIONS PER 1,000 ADULTS**

16		30.7	Charlotte, Concord, Gastonia
24		27.9	Raleigh, Cary
28		27.5	Fayetteville
31		27.0	Greenville
46		24.1	Greensboro, High Point
52		22.6	Durham, Chapel Hill
53		22.6	Wilmington
79		17.7	Winston-Salem
81		17.5	Asheville
110		11.6	Hickory, Lenoir, Morganton

**BUSINESS DYNAMISM RATE**

9		2.0%	Charlotte, Concord, Gastonia
11		1.8%	Asheville
14		1.8%	Raleigh-Cary
31		1.3%	Wilmington
62		0.7%	Durham, Chapel Hill
80		0.3%	Greensboro, High Point
81		0.3%	Fayetteville
83		0.3%	Winston-Salem
96		0.1%	Greenville
97		0.1%	Hickory, Lenoir, Morganton

**FUNDED TOTAL R&D AS A % OF GROSS AREA PRODUCT**

2		10%	Durham, Chapel Hill
18		4.1%	Wilmington
19		3.8%	Raleigh, Cary
28		2.6%	Hickory, Lenoir, Morganton
28		2.6%	Asheville
28		2.6%	Greenville
28		2.6%	Fayetteville
40		1.8%	Greensboro, High Point
71		1.1%	Winston-Salem
90		0.7%	Charlotte, Concord, Gastonia

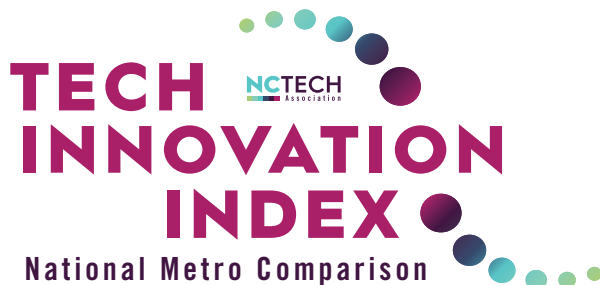
# INSIGHTS

The tech metro index shows which metros have the talent, the demand, and the innovation to maintain, create, and recruit tech business. North Carolina's top metros (Durham, Raleigh, and Charlotte) score well across the board, and rank in the top 30 overall. Some of the smaller metros in the state "punched above their weight" and scored higher than expected based on their population size, particularly Wilmington and Greenville.

There are also opportunities for NC metros to improve their rankings. Outside of the Triangle, the innovation metrics lagged. Fostering more business R&D and entrepreneurship would improve innovation in these other metros. SBIR/STTR funding for startups were very small or zero in five of NC's major metro areas. Several NC metros also had high turnover rates for tech occupations, with Charlotte having the 2nd highest out of all 110 metros in 2021. This could indicate high rates of cannibalism between firms or insufficient hiring and/or training programs for employees. This shows an opportunity for local educational institutions to help ensure that their students are ready to hit the ground running when they start at a local firm. NC metros outside of Durham also scored low in approvals of H1-B visas. This means metros could be missing out on injecting talent to their area.

Compared to last year's results, NC metros scored mostly similarly to the previous year with the big 3 (Durham, Raleigh, and Charlotte) maintaining their spots in the top 30 overall. Most of NC metros maintained or improved on their status from the previous analysis. Greensboro and Fayetteville did drop seven and six spots in the rankings this year, but these were not among the most significant slides in the analysis.

This analysis also highlights where NC metros rank well on several metrics that contribute to their competitiveness. All of the NC metros had positive business dynamism rates, which means more businesses are being created than exiting. Several NC metros scored high in the competitive effect of tech occupation growth. This means job growth is driven by more than just national and tech industry trends. When cost of living is considered, 8 of the top 10 NC metros scored in the top 50 for tech wages.



## APPENDIX

SUPPLY	DESCRIPTION
Resident tech workers per 1,000 adults	The number of tech workers who live within the metro area standardized by the adult population of the metro (over the age of 25).
Computer, math, and statistics degrees per 1,000 adults	The number of adults who had their first major in a computer, math, or statistics degree in the metro standardized by the adult population of the metro.
STEM educational completions per 1,000 adults	Number of completions (certification, degree, or award from a postsecondary institution) in STEM fields standardized by the adult population of the metro.
Number of online profiles in MSA with tech skills per 1,000 adults	Number of online professional profiles that contained any tech skill in the metro area standardized by the adult population of the metro.
Bachelor's degree or higher per 1,000 adults	Number of adults with a bachelor's degree standardized by the adult population of the metro.
H-1B visa approvals per 1000 adults	The number of new and renewed high-skilled immigration work visas standardized by the adult population of the metro.
Diversity of tech occupations relative to total population	The percentage of tech workers who are people of color divided by the percentage of people of color in the general adult population. A value of 100 means the tech workforce is as diverse as the general population of the metro. If lower, less diverse. If higher, more diverse.
DEMAND	DESCRIPTION
Tech occupation location quotient (LQ)	Tech workers % of the total metro workforce compared to the national average. If higher than 1, more concentrated in tech than the national average.
Unique job postings with tech skills per 1,000 adults	Online job postings (with duplicates removed) that required at least one tech skill standardized by the adult population of the metro.
Median job posting duration	The median amount of time it takes for an online job posting with at least one tech skill to be filled.
Cost of living adjusted tech wages	The median hourly wage for tech workers in the metro adjusted for the cost of living in the metro.
Annual tech job openings per 1,000 adults	Openings are the number of jobs that need to be filled to meet growth demand, turnover, and retirement of workers in a year.
Competitive effect of tech job growth	The competitive effect is the actual change in tech workers minus the expected change in tech workers for the metro. The expected change accounts for the national growth and the industry mix. If positive, it means the job growth was higher than expected due to the region's competitive effect.
Turnover rate of employees	The total number of separations in tech jobs divided by the total number of tech jobs. A separation is when a worker's SSN is removed from a company's payroll. This demonstrates the amount of movement occurring in tech jobs.
INNOVATION	DESCRIPTION
Patents per 1,000 workers	The number of registered patents created in a metro area standardized by the number of workers in the metro.
Higher education R&D as % of gross area product	The \$ amount of research & development spending occurring at universities in the metro standardized by the gross area product of the metro.
Business funded higher education R&D as a % of gross area product	The \$ amount of research & development spending occurring at universities that are funded by the private sector in the metro standardized by the private sector gross area product of the metro.
SBIR/STTR funding per \$ of gross area product	The total funding awarded to SBIR/STTR projects in the metro standardized by the gross area product of the metro.
Business Dynamism Rate (Opening vs Closing Rate)	The percentage of business opening compared to the percentage of the business closing in the area. If positive, it means that there is good business churn in the area that contributes to innovation.
Business applications per 1,000 adults	The number of applications people submitted to start businesses in the metro standardized by the adult population of the metro.
Business R&D as a % of gross area product	The \$ amount of research & development that is funded by the private sector in the metro standardized by the private sector gross area product of the metro. For some values there was not data available, in this case the state level was used.

## TECH SKILLS LIST

2D Computer-Aided Drafting And Design	Application Delivery Controller	Blaze Advisor	Computational Design
3D Touch	Application Remediation	Bluecoat Proxies	Computational Tools
3M (Software)	Application Security Testing	Breeze.js	Computer-To-Plate
Accubid (Estimating Software)	AppSense	Build Management	Computer Upgrades
ACORD Forms	Apttus	Business Intelligence Architecture	Conceptual Data Modeling
Adaptive Insights (Software)	Apttus	Business Rules Engines	Construction Management Software
ADDIE Instructional Design Model	Archivists' Toolkit	BuzzSumo (Software)	Content Filtering
Aderant (Software)	ARISg	C3.js	Content Manager OnDemand (CMOD)
Adobe Business Catalyst	ASC 606 (Revenue Recognition)	Call Center Technology	Control-M (Batch Scheduling Software)
Adobe Spark	ASP.NET MVC 5	Canva (Software)	ControlLogix
Adobe Substance	ATG Dynamo	Capital IQ (Software)	Conversational User Interface
ADP PayForce	ATLAS.ti (Qualitative Data Analysis Software)	Cellular Phone Exploitation	Cordova Plugins
Ad Serving	Atlassian OpsGenie	Cerner EHR	Corel AfterShot
Advent Geneva	Atmospheric Modeling	Certified Information System Auditor (CISA)	Correlation Analysis
Agile Product Development	Attribution Modeling	Cisco Certified Internetwork Expert (CCIE) Routing And Switching	Corridor Analysis
Agile Project Management	Audio-Visual Technology	Cisco Certified Internetwork Expert (CCIE) Wireless	Crazy Egg (Website Optimization Tool)
Alexa Skills Kit	Augmented Reality (AR) Headsets	Cisco Certified Network Associate (CCNA) Routing And Switching	Crestron (A/V Systems)
Allen-Bradley Equipment	Automated Machine Learning	Cisco Certified Network Professional (CCNP) Wireless	Crestron Certified Programmer
Amag Symmetry	Automation Controls	CISCO Certified Network Professional - Security	Crimeware
Amazon Comprehend	Autonomous Underwater Vehicle	Cisco Meraki	Cross-Industry Standard Process for Data Mining (CRISP-DM)
Amazon Data Pipeline	Autoregressive Integrated Moving Average (ARIMA)	Citrix Workspace	Custom Scripting
Amazon ElastiCache	Avaya (Telecommunications)	Clarabridge (Software)	Cyber-Physical Systems
Amazon Elastic Container Registry	Avid Media Composer (Software)	Clarizen	CyberArk
Amazon Elastic Container Service	AWS App Mesh	Clinical Informatics	Cyber Defense
Amazon Elastic File System	AWS Auto Scaling	Clip Studio Paint	Cyber Governance
Amazon Forecast	AWS Certified Solutions Architect	Cloud-Native Architecture	Cyber Hygiene
Amazon Lumberyard	AWS CloudHSM	Cloud-Native Computing	Cyber Incident Response
Amazon Macie	AWS CodeCommit	Cloud-Native Computing Foundation (CNCf) Standards	Cyber Operations
Amazon Quantum Ledger Database (QLDB)	AWS CodeDeploy	Cloud Hosting	Cyber Safety
Amazon Textract	AWS Inferentia	Cloud Management	Cyber Security Management
Amazon Translate	AWS Internet Of Things (IoT)	Cloud Management Platforms	Cyber Security Strategy
Amazon WorkSpaces	AWS Key Management Service (KMS)	Cloud Security Applications	CyberX
AMX Programming	AWS Kinesis	Cloud Security Infrastructure	Cypher Query Language
Anaconda (Software)	AWS SageMaker	Cloud Services	Database Activity Monitoring
Android Emulators	Azure Active Directory	Command And Data Handling	Database Architecture
Android Middleware	Azure Command-Line Interface (Azure CLI)	Commercial Off-the-Shelf	Database Conversion
Android Testing	Azure Data Lake	CommVault	Database Management
Apache Administration	Azure Logic Apps	CompTIA Cybersecurity Analyst (CySA+)	Database Modeling
Apache Avro	Azure Security	CompTIA IT Fundamentals	Database Query Tools
Apache Flume	Azure Service Fabric	CompTIA Security+ CE	Database Software
Apache MADlib	Bentley LumenRT		Database Upgrades
Apache Samza	Big Data Analytics		Data Encryption
Apache Thrift	BirchStreet Software		Data Exploitation
Apple Device Enrollment Program			



## TECH SKILLS LIST CONTINUED

Data Highway Plus	(Distribution Software)	Google Fonts	Indegy
Data Interfaces	Equivio (eDiscovery Software)	Google Identity Toolkit	Industrial Control Software
Data Lakes	ES6 Module Loader	Google Keyword Planner	Industry 4.0
Data Literacy	Espresso (Android Testing Framework)	Google Pay	Industry Analysis
Data Management Platforms	eTapestry (Fundraising Software)	GoSystems (Tax Software)	Informatica
DataStax Enterprise Graph	ExactTarget	GPS Data	Informatica Data Validation Option
DeBabelizer	Excel Services	GPU Optimization	Information Systems Architecture
Deep Learning Methods	Expense Forecasting	Graphics APIs	InMoment
Defect Life Cycle	Facebook Advertising	Green Hills Integrity	Interactive 3D
Defense In Depth	FastAPI	GridView	Interactive Web Content
Dell Boomi (Integration Platform)	Fastboot	Growth Hacking	Interactive Web Pages
Dell EMC UniSphere	Fastpath (Software)	Gulp.js	Internetwork Packet Exchange/ Sequenced Packet Exchange (IPX/SPX)
Design Portfolio	Feature Learning	Gulp Sass (Software)	Ionic 4 (Mobile App Framework)
Design Software	Figma (Design Software)	HackerOne	IPSoft Amelia
Desktop Management	FileAid (Software)	Hardware Asset Management	IronPort
Desktop Underwriter	File Naming	Hardware Troubleshooting	iSqFt (Bidding Software)
DevSecOps	Finance Automation	Haskell (Programming Language)	ITIL Foundation Certification
Dialogflow (Google Service)	Financial Aid Software	HCL AppScan	IT Security Documentation
Dialog Programming	Firebase Analytics	Healthcare Analytics	Ivalua (Spend Management Software)
Digital Communications	Firebase Security	Health Management Information Systems	IxChariot (Traffic Generator)
Digital Content Management	Firmware Development	Heuristic Evaluation	Ixia BreakingPoint
Digital Design	Flask (Web Framework)	High Availability Design	IxLoad (Network Testing Tool)
Digital Experience Strategy	FlexSlider	Honeywell Operating System	IxVeriWave (Network Test Tool)
Digital File Management	Foglight (Database Software)	Hootsuite (Social Media Management Software)	Jamf Certification
Digital Rights Management	Forgerock	Host Based Security System (HBSS)	Jobvite
DISA Gold Disk	Free-To-Play Games	Houdini (3D Animation Software)	Julia (Programming Language)
Docker Compose	FullCalendar Premium	HP 3Par	Kendo UI Mobile
DoD Information Technology Portfolio Repository (DITPR)	Full Stack Development	Hybrid Cloud Computing	Kenshoo (Marketing Software)
Dynamic Object-Oriented Requirements System (DOORS)	Gatsby.js	Hyland OnBase	Kochava
E-Kanban	GE iFix	HyperLynx	LabWare LIMS (Software)
EarlGrey (Software)	General Fund Enterprise Business Systems (GFEBS)	HyperWorks (CAE Software)	LAN Administration
Economic Modeling	Geospatial Information Technology (GIT)	IAM Level III Certification	Laptop Troubleshooting
Eggplant Functional	Geospatial Mapping	IBM Guardium	LibGuides
Elixir (Programming Language)	getView	IBM Informix	Life 70 (Software)
Email Service Providers	GIAC Web Application Defender	IBM Initiate	LINQ To Entities
Embarcadero Software	GigE Vision	IBM Integration Designer	Loss Functions
Ember Data	GIS Certificate	IBM Mobile	LS-DYNA (FEA Software)
EMC Avamar	Gmail API	IBM Operational Decision Manager (ODM)	Lumion (3D Rendering Software)
EnCase Certified Examiner	Go-to-Market Strategy	IBM Servers	Mac/Apple Support
Encoder Pro	GoCAD	IBM Sterling B2B Integrator	Machine Learning Methods
Endianness	Google Adwords Certification	IBM Worklight	macOS Sierra
Endpoint Devices	Google Cloud Dataproc	IdentityServer4	Mainframe Testing
Energy Policy Analysis	Google Colaboratory	Image Segmentation	Mapping Software
Enterprise Storage System	Google Display & Video 360	iMessage Extension	MarinOne (Software)
Epicor Prophet 21			

## TECH SKILLS LIST CONTINUED

Marmoset Toolbag	Nuxt.Js	Peoplesoft Administration	Secure Application Development
Material-UI	Nvidia Jetson	Peoplesoft nVision	SeeTest
McAfee Enterprise Security Manager	OCLC Connexion	Performance Profiling	Semantic Parsing
Mechanical Electrical Plumbing (MEP) Design Software	Odoo 10	PHP Frameworks	Server Automation
MeteorJS	Office 365 Admin Center	PinkSoft FStorm	Server Configuration
Micrografx	Office 365 Administration	PMI Professional in Business Analysis	Serverless Security
Microprocessor Architecture	OmniGraffle	Pointclickcare	Shell Commands
Microservices Development	On-Screen Takeoff (Estimating Software)	Poka-Yoke	Shiny (R Package)
Microsites	Online Marketing	Poll Everywhere (Polling Software)	Shopify App
Microsoft 365	Onsen UI	Poppulo	SIS AdvantX
Microsoft Azure Certification	OpenHire (Recruiting Software)	Power Distribution Units	Sizmek (Software)
Microsoft Certified: Azure Fundamentals	OPNET	Presagis Creator	SkyKick
Microsoft Delve	Optitex (Fashion Design Software)	Product Roadmap Management	Small-Unmanned Aerial Systems (S-UAS)
Microsoft Dynamics 365	Oracle Accounts Payable	Project Management Body Of Knowledge (PMBOK) Methodology	Smart Buildings
Microsoft Enterprise Library	Oracle Audit Vault	PVT Analysis	Smart Meter Systems
Microsoft Planner	Oracle Bronto	QAD Cloud ERP	SOA (Service-Oriented Architecture) Testing
Microsoft Simplygon	Oracle Configure-Price-Quote (CPQ)	Qualitative Data Analysis	Social Media APIs
Microsoft Sysprep	Oracle Database Vault	QualysGuard	Social Media Strategy
Microsoft Test Manager	Oracle Demantra	Quantitative Data Analysis	Social Media Trends
MITRE ATT&CK Framework	Oracle Development	Quantum Mechanics	Soft Sensors
mlpack (C++ Library)	Oracle Exalytics	Radare2 (Reverse Engineering Software)	Software-Defined Data Center
Mobile Native Application Testing	Oracle Field Service	Redux-Saga	Software Development Engineer in Test
MobX	Oracle HRMS	Reltio (Master Data Management Software)	Software Installation
MockK	Oracle Human Capital Management (HCM)	Resilient Distributed Datasets (RDD) Programming	Software Strategy
Mod Rewrite	Oracle Identity Analytics	Ridge/LASSO Regressions	Solution Design
mod_perl	Oracle Identity Manager	Robotic Process Automation	Sound Design
Muhimbi	Oracle Javascript Extension Toolkit (JET)	Rockwell FactoryTalk	Spark Core
Natural Language Generation	Oracle Procurement	RSA SecurID	Spark View Engine
Navisworks (BIM Software)	Oracle Retail	Sales Automation Software	Spectre Circuit Simulator
NedGraphics (Textile Design Software)	Oracle Service Contracts	Salesforce Chatter	Sponsored Posts
NetIQ	Oracle SOA Suite	Samsung Gear VR	Sports Analytics
Netskope	Oracle Waveset	SAP Basis	Spring Cloud
NetSuite Financials	OrmLite Servicestack	SAP Business Workflow	Spring Cloud Config
Network Infrastructure	OSI Monarch	SAP Information Steward	Spring Cloud Netflix
Network Science	Outlook Add-Ins	SAP IoT	Spring MVC
NgRx (Framework)	Paint Tool SAI	SAS Business Intelligence (BI)	Spring WebFlux
NgRx Effects	Part-of-Speech Tagging	SAS Enterprise Miner	Sprint Backlogs
NgRx Store	Pega Certified Lead System Architect	SciDB	SpriteKit
Nintex Workflow	Pega Certified Senior System Architect	Scratch Programming	Sprout Social
Nokogiri (Software)	Pega Robotics Software	SCSS Mixins	SQL Backup And Restore
Non-Relational Data Stores	Pelco (Security System)	Searchable Encryption	StarVR
Novell Network			Storage Architecture
			StreamSets

Stripe Connect	TransCAD	UXPin	Web Site Analysis
Supply Base Management	Travel Demand Modeling	UX Research	Web UI Design
Supply Chain Cyber Security	Tricentis Tosca	Vbrick (Software)	WebVR
Sybase (Software)	Tridion Content Delivery	Video Ads	Web Writing
Symantec Altiris	TriZetto Facets	ViewModel	Wget
Synopsys VCS	TriZetto QNXT	Virtualization Security	Windows Performance Analyzer
Synthesio	Troux (Enterprise Architecture Software)	Virtual Reality	Windows Software
System Level Troubleshooting	Udeploy	Vizor.io	Word Embedding
System Recovery	UICollectionView	Vocus (Public Relations Software)	WordPress Admin
System Security Analysis	UIScrollView	Voice User Interface	Worksoft Certify
Technology Strategy Development	UITableView	watchOS	WP Query
Test Datasets	UITableView	WatiN	XLSTAT
TestStand	UIViewController	Watson Conversation	Xsens
Thea Render	Unified Endpoint Management	Watson IoT	XtremIO (Network-Attached Storage System)
Thermal Desktop (Thermal Modeling Software)	UNIGINE Engine	Watson LIMS	ZenHub
ThreatConnect	Universal Image Loader	WCF Security	Zuken (Software)
TIBCO Adapters	Unreal Blueprint	Web Access Control	
TKProf	User Acceptance Testing (UAT)	Web Audio API	
TrackWise	User Journey Mapping	WebGIS	
	UserZoom GO	WebMethods	

## TECH OCCUPATIONS LIST

CODE	DESCRIPTION
11-3021	Computer and Information Systems Managers
15-1211	Computer Systems Analysts
15-1212	Information Security Analysts
15-1221	Computer and Information Research Scientists
15-1231	Computer Network Support Specialists
15-1232	Computer User Support Specialists
15-1241	Computer Network Architects
15-1242	Database Administrators
15-1243	Database Architects
15-1244	Network and Computer Systems Administrators
15-1251	Computer Programmers
15-1252	Software Developers
15-1253	Software Quality Assurance Analysts and Testers
15-1254	Web Developers
15-1255	Web and Digital Interface Designers
15-1299	Computer Occupations, All Other
17-2061	Computer Hardware Engineers



## 2022 RESEARCH UNDERWRITERS

### LEAD UNDERWRITERS



### ASSOCIATE UNDERWRITERS



### CONTRIBUTING UNDERWRITERS



NCTECH.ORG

