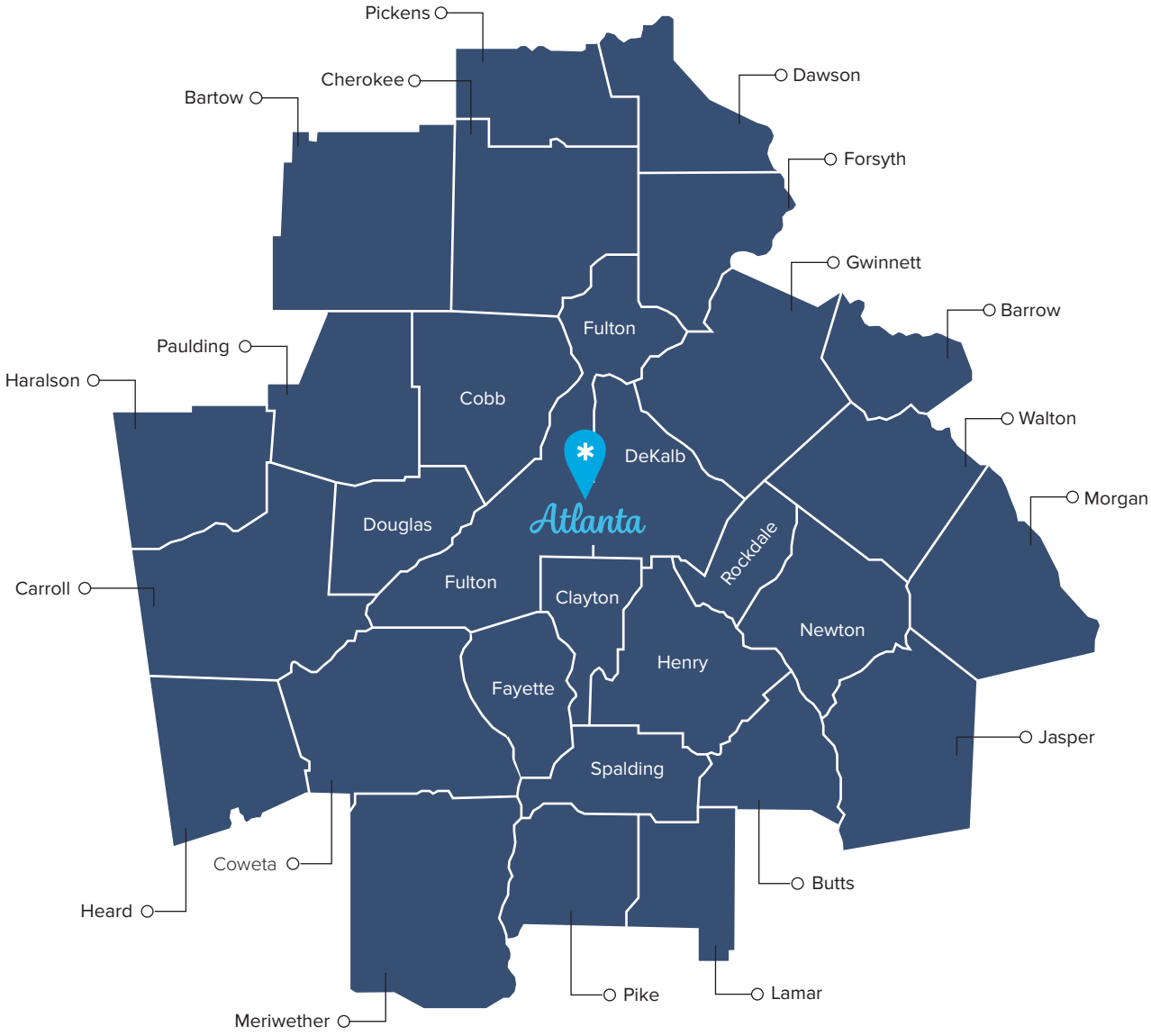
METRO ATLANTA
Innovation Indicators Project



A Look at the Region's Innovation Capacity

November 2014

About this Project

The Metro Atlanta Innovation Indicators Project is the first comprehensive evaluation of innovation data for the 29-county region. It illustrates how Metro Atlanta is performing on thirteen different measures of innovation relative to its own history and compared to other regions throughout the U.S. that are recognized as innovation leaders. This project was commissioned to establish baseline metrics to inform actions and measure the impact of current and future efforts designed to build the region's innovation capacity.

The data reveals that Metro Atlanta is growing by nearly all measures of innovation evaluated, including high-tech jobs, highly educated people, academic research expenditures and productivity, patent activity and early stage venture capital investment. Areas requiring greater focus in order to strengthen the region's innovation economy and remain globally competitive include the concentration of talent and high-tech jobs, mid and late stage commercialization funding, and growth and attraction of innovation-based industries. For more information about the Metro Atlanta Innovation Indicators Project and its findings, visit www.startupatlanta.org.

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Collaborative Economics (COECON) is a strategic advisory and consulting firm that works with clients to create breakthrough solutions for regions and communities. COECON works with businesses, foundations, government, education, and community sectors to do leading edge clean economy, innovation, and sector analysis for states and regions across the country.

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This project was made possible by funding from:

Invest Atlanta
Metro Atlanta Chamber

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* **Innovation** is not a set of programs or policies, rather it is the ability to react to the constant economic change driven by key innovation-based sectors throughout Metro Atlanta. The more nimble the region is at addressing changing innovation needs, the greater the ability for Metro Atlanta to grow its innovation-based industries, a key to future regional prosperity.

The Metro Atlanta Innovation Indicators Project was commissioned to examine the diverse innovation activities within Metro Atlanta's large and complex regional economy. With the ninth-largest metro population in the country and 28 FORTUNE 1000 headquarters, Metro Atlanta has developed a strong economic base. As the global economy is increasingly driven by innovation-based industries, remaining competitive requires keeping pace with other regions in developing and retaining talent, attracting innovative companies, developing new technologies and producing new products and services for export. By tracking a series of innovation indicators, a more complete picture of the region's innovation capacity becomes apparent, and can be evaluated and acted upon to enable the region to better compete in the 21st century economy.

This Innovation Indicators Project is designed to:

- Monitor regional trends
- Benchmark activity against other leading innovation regions
- Communicate results about the competitiveness of the region

The innovation indicators examined in this report reveal Metro Atlanta's strengths, as well as areas in which a greater focus will strengthen the region's competitiveness. Key strengths and areas for greater focus identified in this first Metro Atlanta Innovation Indicators Project include:

* STRENGTHS

Highly educated talent and high-tech jobs

- From 2007 to 2012, Metro Atlanta's population of adult workers grew four percent, while the population of highly educated adults grew twice as fast at eight percent.
- Over the past decade, Metro Atlanta has created jobs in high-tech industries that attract and retain talented individuals. The number of high-tech jobs increased 19 percent between 2003 and 2013.

Academic institutions are attracting dollars and putting them to use

- Total university research and development expenditures reached nearly two billion dollars in 2012, a 22 percent increase since 2004.
- In the same time period (2008-2012), the number of academic licenses executed by area institutions grew 94 percent. Productivity of research dollars is high and increasing.

Large innovation-based industry sectors

- Metro Atlanta's total employment in innovation-based industries, including technology and bioscience, reached over 160,000 jobs in 2012. Coming out of the recession, jobs in innovation-based industries have increased 4 percent.

* AREAS FOR GREATER FOCUS

Concentration and growth of talent and opportunity

- High-tech jobs number in the hundreds of thousands, but the relative concentration of these jobs lags other innovation regions when normalized by population.
- Concentration of highly educated adults, while improving, is still significantly lower than other innovation regions.
- The number of high-tech jobs and educated adults is growing, but not as fast as other innovation regions.

Commercialization

- There is an opportunity to improve later-stage commercialization activities throughout Metro Atlanta, such as increasing access to capital for startup companies.

Attracting innovative industries

- Diversified economies anchored in innovative industries sustain strong growth. Metro Atlanta's concentration of employment and wages in innovation industries is lower than other innovation regions.

Metro Atlanta in the Innovation Economy

Over the last few decades, innovation and knowledge-based economies have become synonymous with economic resiliency. Emerging from the recession, communities everywhere are taking stock of their ability to compete in the global economy where speed, knowledge, and customization outweigh previous competitiveness metrics. In the United States and other industrialized countries, competing solely on the basis of labor costs or natural resources is no longer possible.

Rooted in knowledge, technology, and entrepreneurship, the innovation-based economy is characterized by the development of new products, new processes and new technologies. Science, technology, engineering, and math (STEM) jobs are central to innovation-based economies, and entrepreneurs, innovative leaders, and capital are all key to pushing new products and processes to market.

What is Innovation Capacity?

Innovation capacity reflects a region's potential to grow its innovation-based economy. It is comprised of a set of interacting resources and processes, which form the foundation for the region to generate new ideas, commercialize technologies, and ultimately cultivate globally competitive businesses. Resources such as STEM and entrepreneurial talent, risk capital, local universities and R&D are key elements underlying a region's innovation capacity.

A region's ability to bolster its innovation capacity, or produce these new products, processes and technologies, will be a defining characteristic of regional prosperity as our national economy becomes more reliant on these types of exports. Innovation capacity is dependent on a region's ability to cultivate and attract raw innovation resources, convert them to innovative products, and then scale and export those products.

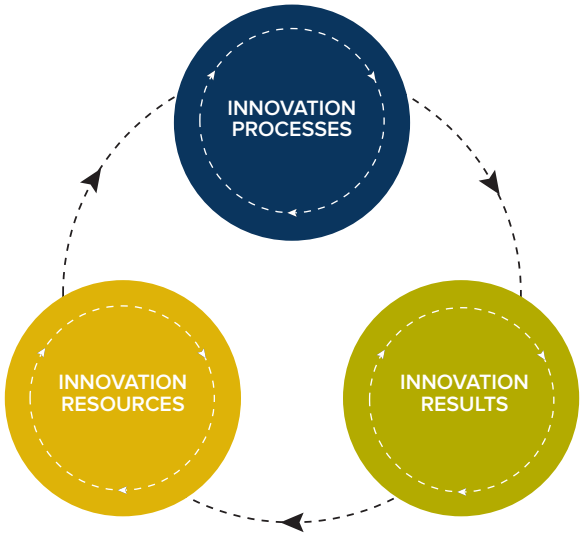
The Metro Atlanta Innovation Indicators Project was a collective effort by multiple regional organizations to analyze Metro Atlanta's innovation capacity. This report serves as a benchmark of Metro Atlanta's current innovation ecosystem that should be used to inform actions, measure progress and celebrate success.

A Framework for Innovation

Understanding Metro Atlanta's innovation capacity requires analysis of diverse pieces of the region's economy. An innovation-based economy is centered around the development, commercialization, and deployment of science and technology.

A traditional economic model might simply measure inputs and outputs to calibrate regional activity, quantifying investment in new technologies and their later profitability. In contrast, analysis of innovation capacity focuses on understanding the full spectrum of the innovation-based economy, from resources, to processes, to results. In particular, defining the processes of converting ideas or knowledge into products with marketable value is of great importance for a region to grow its innovation ecosystem.

This report evaluates innovation capacity by examining three components that together comprise an innovation ecosystem: resources, processes, and results.



Resources: Innovation resources are the basis of the innovation economy. This includes a region's talent base of scientists, researchers, and skilled entrepreneurs who help develop commercializable products, as well as innovative leaders with business acumen who take prototypes and early-stage companies to scale. These individuals and the relationships they build are key to the success of an innovation ecosystem. This section will measure the educational attainment of adults in innovation regions, the prevalence of STEM degrees awarded by area institutions, and high-tech occupation growth and concentration. Other resources that fuel innovation economies include infrastructure such as broadband, laboratory space, data storage centers, and technology office parks. Community assets that attract talent to a region, such as universities or research laboratories, large innovative firms, and high quality of life for individuals and families can also be considered innovation resources.

Processes: Innovation processes include the continuum of activities required to turn ideas into marketable products. This framework identifies three overlapping, somewhat sequential, phases of the innovation process: idea generation, commercialization, and business innovation. Some innovation processes measured in this section include academic research expenditures, patent activity, licenses executed by universities, and commercialization funding, such as venture capital. Finding ways to measure these innovation processes—the conversion of raw ideas into marketable products—can be very difficult, particularly when trying to account for the activities of large, innovation-driven corporations. These corporations play an important role in the innovation economy. While the focus is often on startup businesses, large anchor firms create a necessary economic environment for innovation to thrive by investing in new technologies, acquiring firms, serving as customers, and creating market opportunities. However, measuring corporate spending on research & development activities, investment in new businesses, or connectivity to academic institutions is often not possible as this information is necessarily kept private. Despite these limitations, some metrics, such as startup company exit activity, do offer a glimpse of the innovation processes and connectivity in the private sector.

Results: The strength of innovation economies is measured by regional prosperity: good jobs in high-tech occupations, competitive wages, strong export markets, and the size and concentration of the region's innovation-based sectors. Results measured in this report include employment in innovation-based industries and associated wages. Other indicators that measure innovation results include the productivity of innovation sectors, per capita wealth, and improvements in other quality of life measurements.

Introduction to Comparison Regions

This report utilizes comparison regions to determine how Metro Atlanta is performing relative to potential competitors. As innovation capacity becomes an increasingly important factor in global competitiveness, regions will compete with one another for talent, local investment capital, and other innovation resources. Comparison regions were not selected based on compatible demographic profiles (e.g., size, location, etc.) but because they are well known or emerging as innovation centers. This allows for the evaluation of Metro Atlanta in the context of other regions who are invested in growing their innovation economies and will compete for markets and resources in the future.

In some instances, this report will differentiate between "Core Atlanta" and "Metro Atlanta." Core Atlanta is the ten county region recognized by the Atlanta Regional Commission (see table below). Metro Atlanta is the 29-county metropolitan statistical area (MSA) defined by the United States Office of Management and Budget and used by federal and state agencies for reporting purposes. This differentiation is primarily to highlight (when data allows) activities occurring in the regional core, where the majority of Metro Atlanta residents live and work and where innovation activity is concentrated.

This report measures the resources, processes and results of Metro Atlanta's innovation economy and tracks the region's progress in comparison to other innovation regions. It is meant to provide a baseline of absolute and normalized measures against which the region can benchmark itself moving forward.

Population Change
Core Atlanta*, Metro Atlanta and Select Innovation Regions - 2003, 2007 and 2013

	MSA(s)	2003	2007	2013	Change 2003-2013
Core Atlanta*	-	3,622,417	3,949,274	4,306,244	19%
Metro Atlanta	Atlanta-Sandy Springs-Marietta, GA Metro Area**	4,572,541	5,066,356	5,522,942	21%
Austin	Austin-Round Rock-San Marcos, TX Metro Area	1,376,030	1,577,856	1,883,051	37%
Boston	Boston-Cambridge-Quincy, MA-NH Metro Area	4,434,723	4,447,838	4,684,299	6%
Denver & Boulder	Boulder and Denver-Aurora-Broomfield, CO Metro Area	2,772,502	2,943,806	3,277,309	18%
Research Triangle	Durham-Chapel Hill and Raleigh-Cary	1,572,760	1,775,083	2,037,430	30%
San Diego	San Diego-Carlsbad-San Marcos, CA Metro Area	2,914,702	2,975,742	3,211,252	10%

*Core Atlanta is comprised of Cherokee, Clayton, Cobb, DeKalb, Douglas, Fayette, Fulton, Gwinnet, Henry, and Rockdale counties.
** In 2013 the Office of Management and Budget updated Metro Area definitions. This is the current MSA for the Atlanta Metro, but public data through 2013 still conforms to earlier MSA definitions. For all other Innovation Regions, the 2012 Metro Area definition is used.
Data Source: U.S. Census Bureau, Population Division
Analysis: Collaborative Economics

Metro Atlanta is growing high-tech jobs and highly educated talent, but concentration of talent and opportunity is lower than other innovation regions. Talented, educated people fuel innovation economies. The ability to attract talented people is key to launching new endeavors and helping existing firms take their work to the next level.

Adult Education Levels

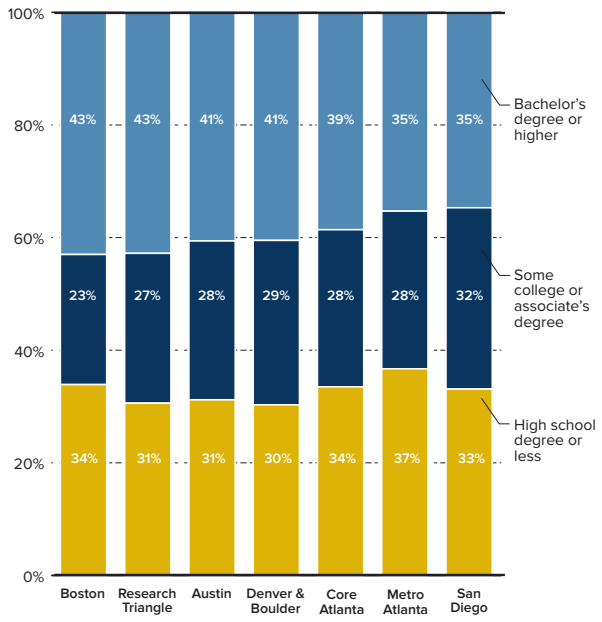
The number of highly educated adults is an important component of an innovation economy since many jobs in innovation-based sectors require post-secondary education.

In 2012, the most recent year for which data was available, Boston and the Research Triangle led all other comparison regions with 43 percent of adults holding a bachelor's degree or higher, followed by Austin and Denver & Boulder with 41 percent. With 39 percent of adults holding a bachelor's degree or higher, Core Atlanta performed better than the larger 29-county Metro region (35%) and San Diego (35%). Metro Atlanta also had the largest percentage of adults who had earned a high school degree or less (37%) relative to other innovation regions.

Despite a lower concentration of highly educated adults than other innovation regions, the educational composition of the Metro Atlanta region is trending positively towards a more educated population. Metro Atlanta's adult population with some college or an associate's degree grew over 20 percent from 2005 to 2012, and the population of adults with a bachelor's degree or higher rose approximately 17 percent. Inversely, the concentration of adults with a high school degree or lower has been shrinking since 2007.

Adult Education Levels

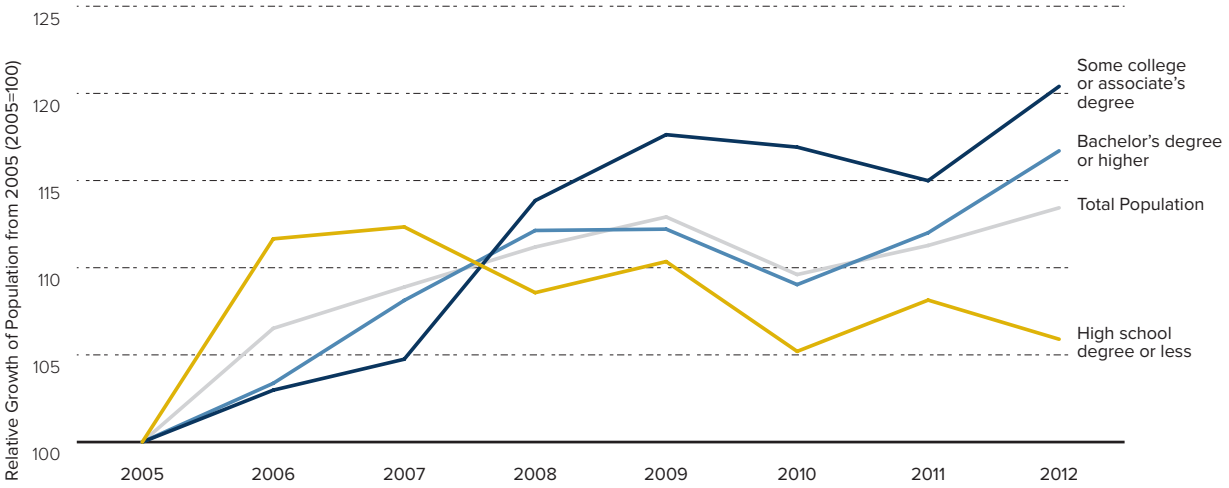
Core Atlanta, Metro Atlanta and Select Innovation Regions 2012



*** Atlanta's adult population is growing and becoming more highly educated.**

Relative Growth of Adult Population by Education Level

Metro Atlanta, 2005-2012



Data Source: U.S. Census Bureau, American Community Survey Analysis: Collaborative Economics

Change in Adult Population

Both Metro and Core Atlanta experienced significant growth in the number of educated adults in the region from 2011 to 2012. This includes adults who moved to the region, residents who received a higher education degree, and individuals who turned 25 years old during that year. From 2011 to 2012, Core Atlanta's adult population grew just under five percent, while its population of adults with a bachelor's degree or higher increased over six percent. This represents the largest increase of adults with a bachelor's degree or higher of any comparison region, when measured both by percentage and in absolute numbers. The larger Metro region also witnessed growth in the number of adults with a bachelor's degree or higher. In 2012, over 50,000 more adults with a bachelor's degree or higher resided in the 29-county region compared to 2011, representing a 4.2 percent growth rate. The total adult population of the Metro region grew nearly two percent in the same time period.

Collectively, this data reflects an overall improvement of educational attainment in the Metro Atlanta adult population, which has positive implications for its innovation-based economy.

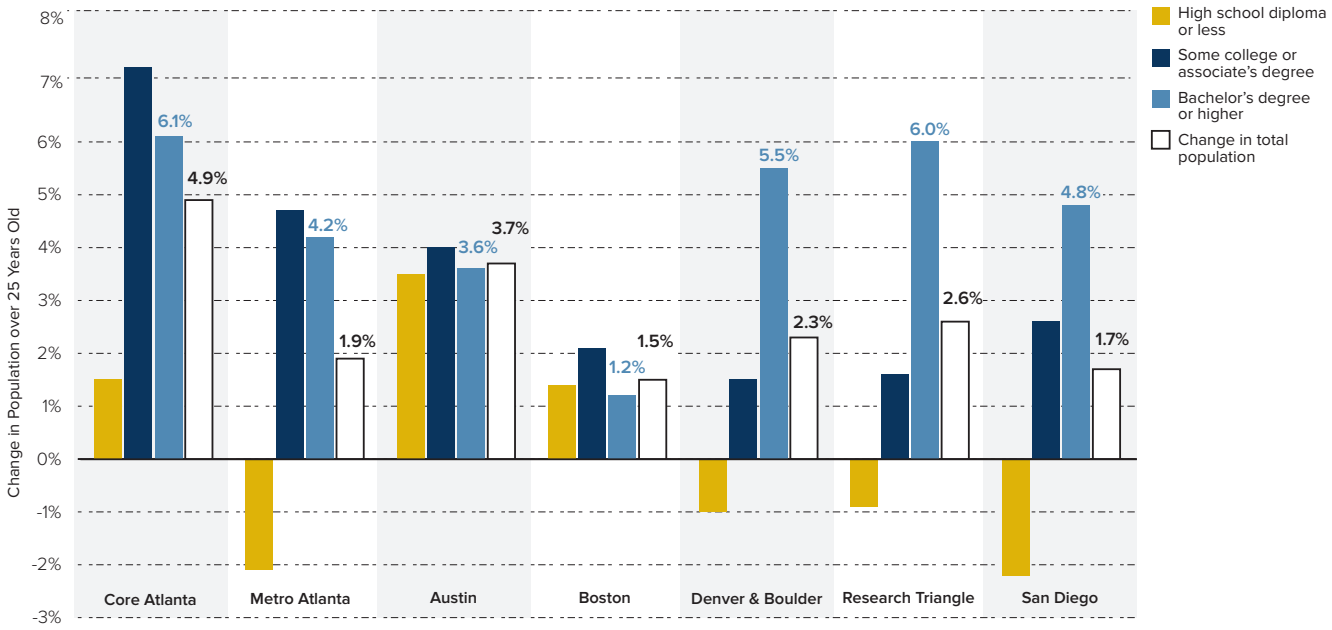
Net Change in Adult Population
Core Atlanta, Metro Atlanta and Select Innovation Regions 2011-2012

	Bachelor's Degree or Higher	Total Change in Adult Population
Core Atlanta	61,598	128,002
Metro Atlanta	50,058	67,017
Austin	16,532	41,579
Boston	16,648	47,131
Denver & Boulder	45,059	47,997
Research Triangle	26,890	28,594
San Diego	32,870	34,654

*** Metro Atlanta's recent growth spurt, and particularly the improvement in educational attainment of its adult population, has positive implications for the region's innovation-based economy.**

Change in Adult Population by Education Levels

Core Atlanta, Metro Atlanta and Select Innovation Regions, 2011-2012



Note: Change in adult population includes persons who become 25 years old in addition to net migration in and out of the region.

Data Source: U.S. Census Bureau, American Community Survey
Analysis: Collaborative Economics

STEM Graduates

Science and technology industries are the root of innovation economies and are correlated with economic growth.[1] The ability to produce and attract local talent in science, technology, engineering, and math (STEM)[2] is a key component to growing these industries and drives a strong innovation economy.

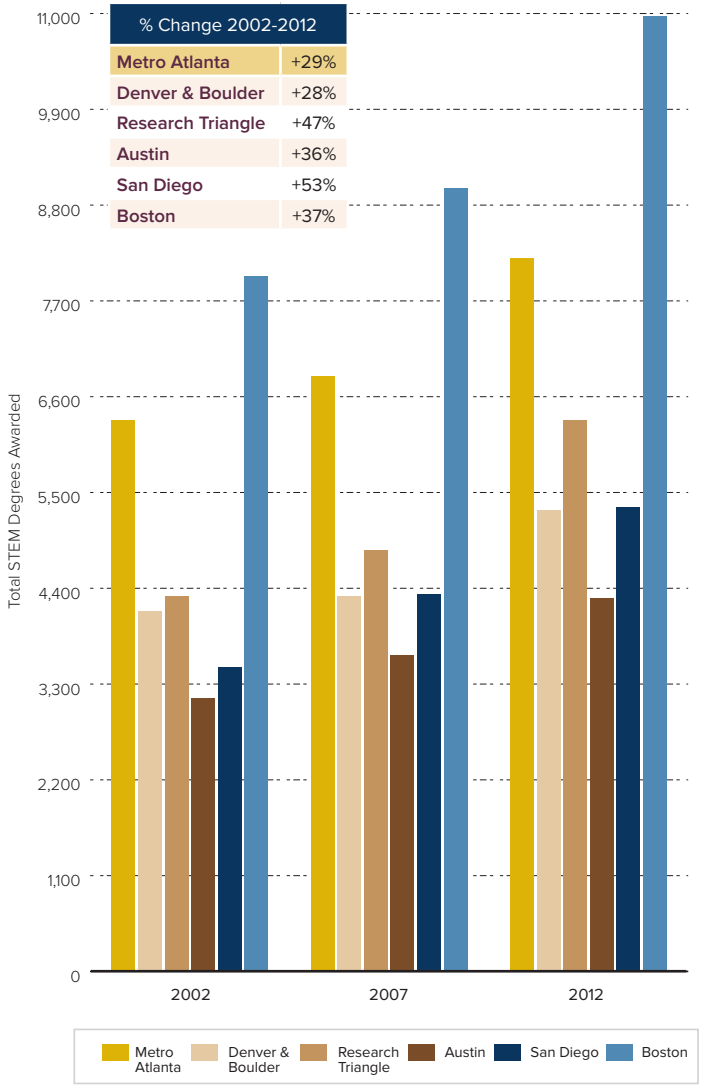
The number of STEM degrees awarded in the Metro Atlanta region has grown steadily over the last decade. In 2012, Metro Atlanta institutions and the University of Georgia awarded over 8,000 STEM degrees, second only to Boston-area institutions, which awarded nearly 11,000 STEM degrees. This suggests there is an intentional effort by Metro Atlanta's higher education institutions to employ educators, offer programming, and attract and produce talent that advances the innovation economy.

The number of STEM degrees conferred by institutions in the two smaller comparison regions, Austin and Research Triangle, has grown more rapidly than in Metro Atlanta. From 2002 to 2012, the number of STEM degrees awarded by Metro Atlanta institutions and the University of Georgia grew 29 percent, compared to 36 percent in Austin and 47 percent in the Research Triangle.

*** The number of students graduating from Metro Atlanta institutions with STEM degrees is increasing, but the rate of growth lags other innovation regions.**

Total STEM Graduates

Metro Atlanta and Select Innovation Regions
2002, 2007 and 2012



Data Source: U.S. Census Bureau, American Community Survey
Analysis: Collaborative Economics

1 West, Darrell M. *Technology and the Innovation Economy*. Washington DC: Center for Innovation Technology at Brookings, 2011.
2 See Appendix for STEM degree definition.

High-tech Occupations

Academic institutions play a key role in attracting students and researchers to the region, but the presence of high-tech job opportunities is equally important for attracting and retaining the talent needed to cultivate the region's innovation capacity. A concentration of high-tech occupations reflects a strong employer base of innovative companies. A high concentration also attracts new employers looking for a certain intensity of talent and companies throughout the supply chain, ranging from R&D labs to manufacturing and services. High concentrations of high-tech occupations can also lead to specialized services for innovation industries and create "knowledge spillover" or the transfer of knowledge from one corporation to another through a shared talent pool.[3]

Metro Atlanta employs nearly 120,000 individuals in high-tech occupations,[4] tens of thousands more than most of the other comparison regions, indicating a profusion of innovation-based activity. However, the percentage of people employed in high-tech occupations relative to total employment, or the "concentration", is lower than all other comparison regions. The growth rate of high-tech occupations also lags the other innovation regions.

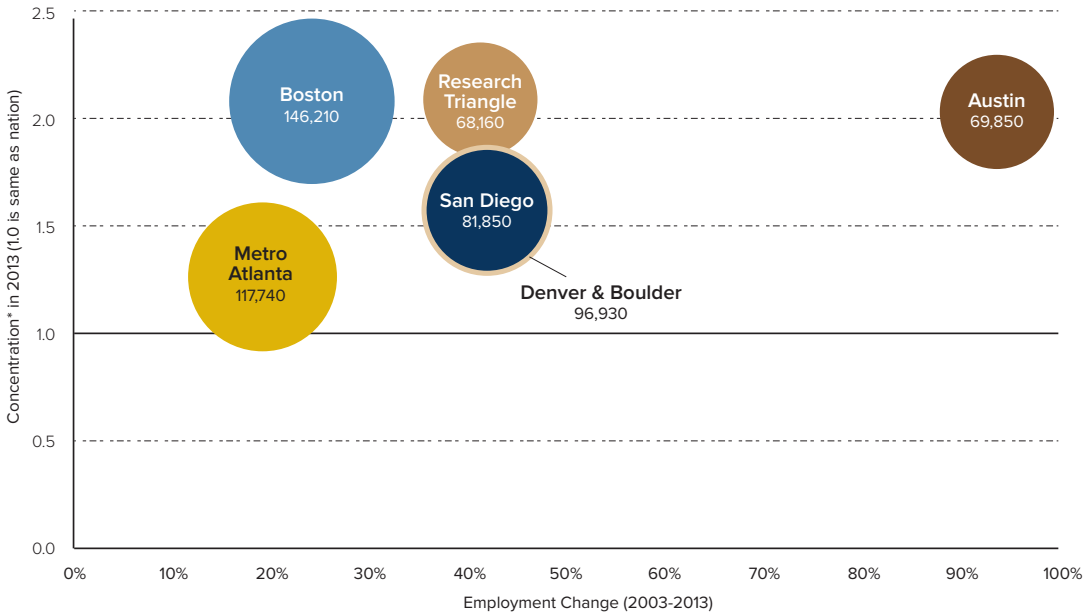
Metro Atlanta's concentration figures suggest the region is slightly less specialized in innovation-based activities than its competitor regions. However, it performs above the U.S. average (U.S. average concentration in high-tech occupations is 1.0). Boston has the largest total number of high-tech jobs with over 146,000. Its concentration, which is over twice the national average, is also higher than all the other comparison regions, including smaller, faster-growing regions like the Research Triangle and Austin.

The number of high-tech jobs in Austin is increasing faster than all other comparison regions. Approaching 70,000 high-tech jobs in 2013 — just over half the number of high-tech jobs in Metro Atlanta — Austin has doubled its number of high-tech jobs over the last decade. San Diego, Denver & Boulder, and the Research Triangle have increased the number of high-tech jobs in their regions by approximately 40 percent over the same time period. Significantly larger regions, Boston and Metro Atlanta, have increased high-tech occupations by 25 and 20 percent, respectively, over the last decade.

*** Metro Atlanta has a large number of high-tech jobs, but growth rate and concentration lag other innovation regions.**

Concentration of High Technology Occupations

Metro Atlanta and Select Innovation Regions, 2003-2013



How to Read a Bubble Chart

A bubble chart provides perspective on three dimensions: the size, growth and employment concentration* in a cluster. The x-axis is the employment change between 2003 and 2013. The y-axis is the employment concentration relative to the nation in 2013, and the size of the bubble correlates with the number of jobs in 2013. A concentration of 1.0 is equal to the national average.

Note: San Diego and Denver & Boulder Regions have the same concentration.
*Concentration is calculated as Regional High-Tech Emp/Regional Total Emp)/(National High-Tech Emp/National Total Emp)
Data Source: Bureau of Labor Statistics, Occupational Employment Statistics
Analysis: Collaborative Economics

[3] Moretti, Enrico. The New Geography of Jobs. Boston: Houghton Mifflin Harcourt, 2011
[4] See Appendix for definition of high-tech occupations.

Metro Atlanta's strong innovation resources translate unevenly to innovation processes. Innovation processes include the continuum of activities involved in turning ideas into marketable products. Processes include research, fundraising, business creation, and startup business exits, among others. This framework identifies three distinct, somewhat sequential, overlapping areas of innovation processes: idea generation, commercialization, and business innovation. Analyzing different stages of the innovation process reveals a more refined view of the region's innovation ecosystem.

Idea Generation

The first stage of the innovation process is idea generation. To measure idea generation, this report evaluates academic research expenditures and regional patent activity. Metro Atlanta's academic research expenditures have grown over the last decade, signaling that Metro Atlanta institutions are competing effectively for public and private research funding. In the same time period, patent activity throughout the region has doubled.

Commercialization

Commercialization activities are diverse but generally sequential. Early-stage commercialization activity typically involves translating new ideas generated from research into useful and marketable applications. This report uses academic licensing and startup activity to assess early-stage commercialization activity in the region. Mid-stage commercialization involves activities such as prototyping and proof of concept testing, which often require capital investment. This report includes angel and seed investment, Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) grants, and series A venture capital funding as indicators of mid-stage commercialization activity. Later-stage commercialization generally involves product development, launch and marketing and typically requires additional capital investment. This report measures later-stage commercialization activity by evaluating venture capital funding as well as other forms of private financing such as debt and alternative equity arrangements.

Metro Atlanta academic institutions perform well in the earliest stages of commercialization. Licensing activity is growing and the productivity of research dollars is very high. In the later stages, as measured by SBIR/STTR funding and angel capital investment, Metro Atlanta falls behind other innovation regions, especially considering its size and relative innovation resources.

Business Innovation

A healthy innovation economy does not rely solely on startup companies. In fact, mature innovation economies are anchored by large, established firms that have the capacity and resources to scale new technologies. Business innovation is the final innovation process and speaks to the relationships among established firms, the startup business community, and regional research assets. Business innovation is measured in this report by exit activity, such as mergers and acquisitions and initial public offerings. Despite seemingly weaker mid-stage innovation processes compared to other innovation regions, Metro Atlanta firms have a solid exit pattern and the region's mergers and acquisitions market is active. This may signal that startups who surpass these mid-stage hurdles are becoming valuable acquisition candidates for established firms.

Research and Development (R&D) Expenditures

The ability to produce technological breakthroughs is a foundational element of an innovation economy. New technologies create new products, business, services and even new markets. Many of these breakthrough technologies originate in academic or publicly funded research institutions. These entities perform a wide spectrum of research activities, from publicly funded basic research to applied research funded by private companies. A region's ability to attract research funding is a critical sign of how productive (and competitive) its academic research community is. The ability of a region's academic and research institutions to attract research funding is of key importance to its ability to generate new ideas and products.

Metro Atlanta is competitive with the comparison innovation regions in terms of academic research expenditures. In 2012, Metro Atlanta's higher education institutions, including the University of Georgia, spent $1.77 billion on research, trailing Boston and Research Triangle-area institutions, which spent $2.65 and $2.31 billion, respectively. Not surprisingly, the largest source of R&D funds for institutions in all comparison regions was the federal government. Boston expended $1.82 billion in federal R&D funds, followed by the Research Triangle ($1.38 billion), San Diego ($1.16 billion) and Metro Atlanta ($1.09 billion). Metro Atlanta institutions contributed more funding to R&D at their respective organizations than those in all other comparison regions. In 2012, of the $1.77 billion Metro Atlanta institutions spent on R&D, 26 percent was sourced by the institutions themselves, compared to 12 percent for Boston and 17 percent for the Research Triangle. However, Metro Atlanta lagged the Research Triangle, Boston, and San Diego in attracting research funds from private businesses. While non-federal sources of research funding represent a smaller portion of expenditures, diversification of research dollars is important as attracting federal funds becomes more and more competitive.

Despite positive growth overall, the rate of academic R&D expenditure growth for Metro Atlanta is slower than that of the other innovation regions. Since 2004, total R&D expenditures for Metro Atlanta academic institutions have grown by approximately 22 percent, but Research Triangle (+53%), Boston (+41%), San Diego (+34%), and Austin (+26%) have grown faster.

Total Academic R&D Expenditures* by Source in Billions of Dollars
Metro Atlanta and Select Innovation Regions, 2012

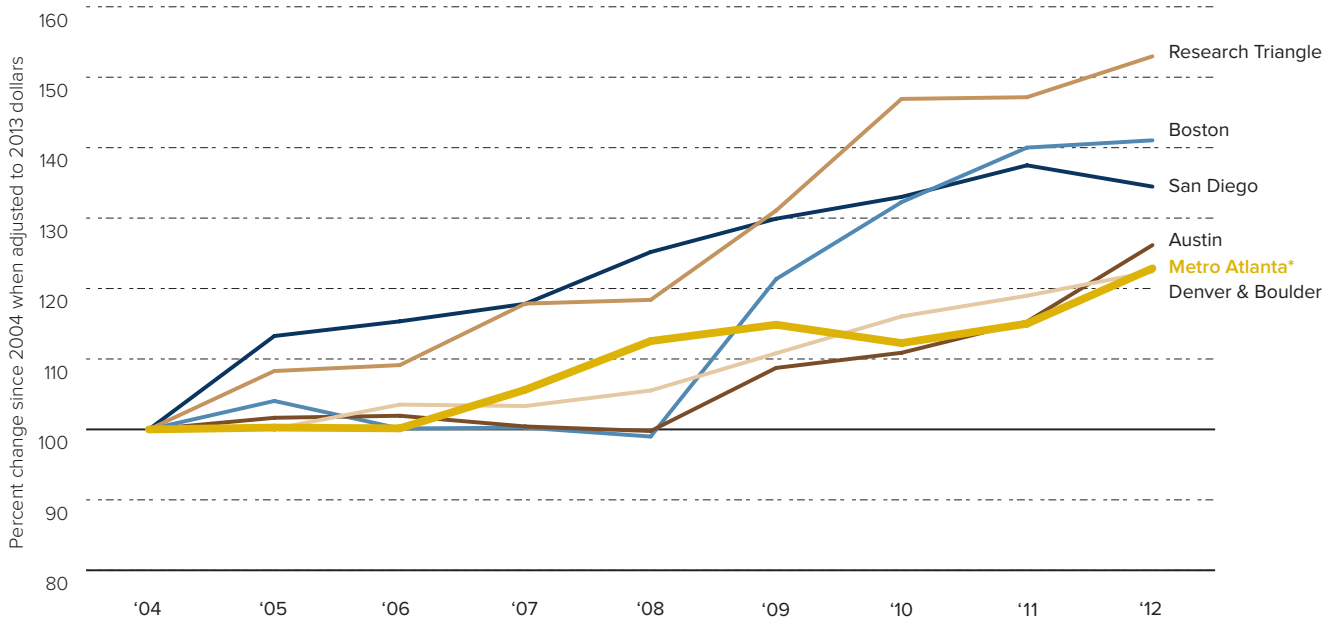
	Federal government	State and local government	Institution funds	Business	Nonprofit organizations	All other sources	TOTAL
Boston	$1.82	$0.01	$0.31	$0.20	$0.24	$0.06	**$2.65**
Research Triangle	$1.38	$0.10	$0.39	$0.30	$0.14	$0.00	**$2.31**
Metro Atlanta**	$1.09	$0.05	$0.45	$0.08	$0.09	$0.01	**$1.77**
San Diego	$1.16	$0.07	$0.20	$0.10	$0.13	$0.06	**$1.71**
Denver & Boulder	$0.69	$0.02	$0.07	$0.06	$0.05	$0.01	**$0.90**
Austin	$0.40	$0.06	$0.17	$0.07	$0.04	$0.01	**$0.75**

* Data in 2012 dollars
** Metro Atlanta includes UGA
Data Source: National Science Foundation
Analysis: Collaborative Economics

*** Metro Atlanta academic research and development expenditures are high and growing.**

Relative Growth of Academic R&D Funding

Metro Atlanta and Select Innovation Regions, 2004-2012



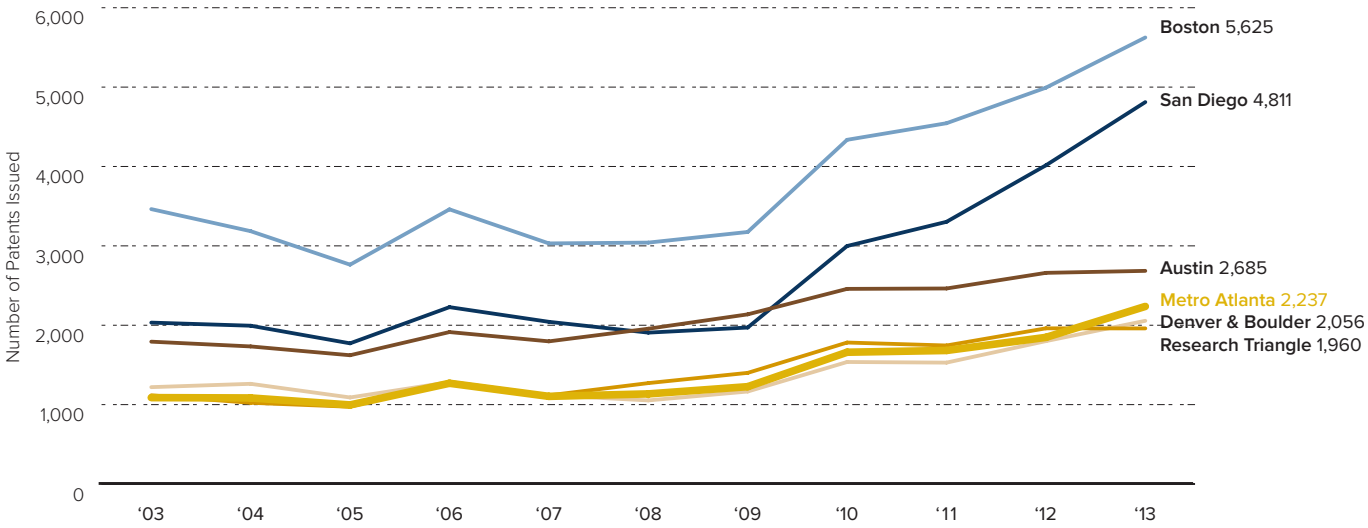
* Metro Atlanta includes UGA
Data Source: National Science Foundation
Analysis: Collaborative Economics

Patents

Patents often result from R&D activity and reflect valuable intellectual property being developed by individuals, universities and companies. A patent is issued when the United States Patent and Trademark Office (USPTO) deems an invention to be novel, useful and non-obvious. Certain rights, such as the right to exclude others from making, using or selling the invention for a set period of time, are conferred to the owner of the patent upon issuance. Those rights can be used exclusively by the owner or licensed to other entities to facilitate creation of new products and businesses, or improve existing products and processes. Patents are a measure of innovation activity in that, by definition, they represent new and useful innovations. Patent activity as measured in this report includes patents issued to individuals, the private sector and academic research institutions, thus providing a broader view of the region's idea generation capacity than measuring academic R&D expenditures alone.

Total Patents Issued

Metro Atlanta and Select Innovation Regions, 2003-2013



Data Source: USPTO, includes utility patents only
Analysis: Collaborative Economics

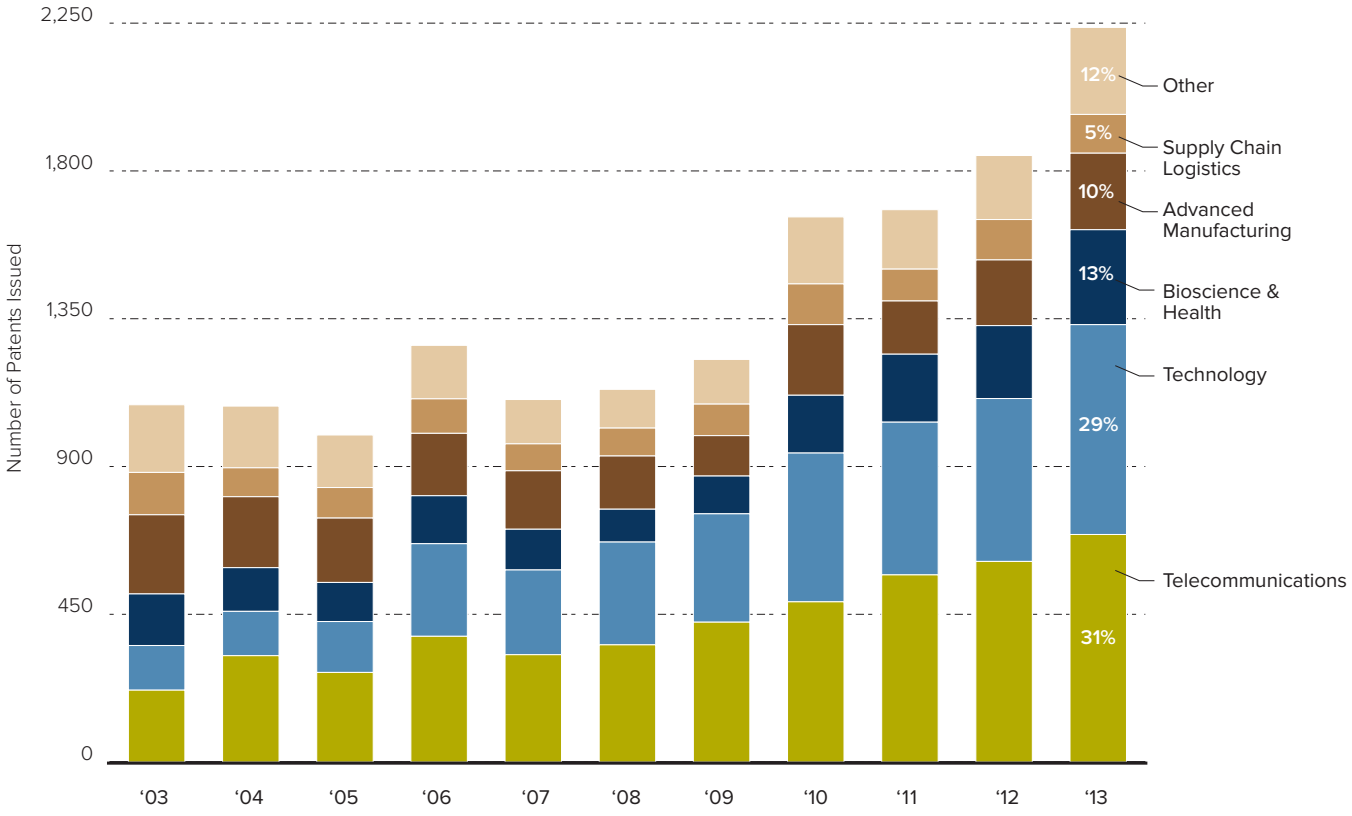
Metro Atlanta's patent activity has more than doubled over the last decade, increasing 106 percent. Only San Diego has experienced a higher rate of growth at 137 percent since 2003. In the same time period, the number of patents issued increased by 75 percent in the Research Triangle, 69 percent in Denver & Boulder, 62 percent in Boston, and by 50 percent in Austin.

Despite gains over the past decade, the number of patents issued for Metro Atlanta is generally lower than for the other innovation regions. However, in 2013, Metro Atlanta surpassed both the Research Triangle and Denver & Boulder in the total number of patents awarded. In 2013, 2,237 patents were issued to Metro Atlanta individuals, companies, universities and research institutions, a 21 percent increase over the 1,847 patents issued in 2012. In 2013, 1,960 patents were issued to Research Triangle inventors and 2,056 to Denver & Boulder inventors. Of all comparison regions, Boston has led continuously over the last decade and was awarded over 5,500 patents in 2013.

Metro Atlanta's patent activity is concentrated in telecommunications, technology, bioscience, and advanced manufacturing, sectors that represent a critical base of activity for Metro Atlanta's innovation economy. In 2013, 83 percent of Metro Atlanta's patents were issued in these sectors. While lagging other innovation regions in terms of overall activity, Metro Atlanta's patent activity correlates to anchor industries in the region, suggesting that key Metro businesses are remaining innovative and globally competitive.

Total Patents Issued by Major Technology Areas

Metro Atlanta, 2003-2013



Data Source: USPTO, includes Utility Patents Only
Analysis: Collaborative Economics

Early-stage commercialization activity typically involves translating new ideas generated from research into useful and marketable applications. University licenses and startup companies based on university intellectual property are two measures of the effectiveness with which academic research outputs are transferred to the private sector. Metro Atlanta, especially when normalized to research funding, performs well by these measures.

Academic Licenses and Startups

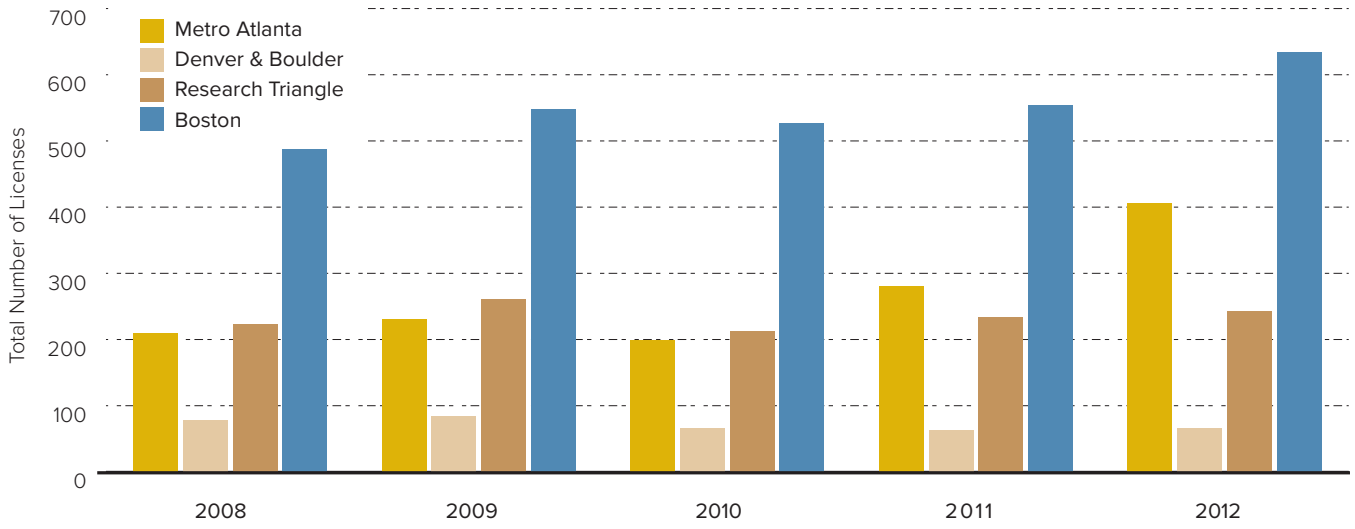
Universities and research institutions perform research, funded in large part by the federal government, that often leads to new discoveries. A region's ability to effectively turn these new discoveries into products and services that benefit the public relies heavily on close partnerships with the private sector. New ideas with commercial applications are typically licensed to existing companies, or inspire creation of new companies, for further development. The transfer of new ideas and technologies from the academic sector to the private sector creates new markets, business opportunities, and jobs. Robust licensing and startup activity signals that regional academic institutions are working with outside entities to ensure that public investments in research are resulting in regional economic growth and benefiting society.

Academic institutions are well-equipped to do research but not to perform the development work required to turn new ideas into products or to operate businesses. Therefore, it is essential to transfer the research discoveries with commercial potential to the private sector for further development and commercialization. Institutions typically do this by licensing their intellectual property rights to existing firms or to startup companies created for the purpose of commercializing the new technologies.

*** Early-stage commercialization across academic institutions is generally strong.**

Academic Licenses

Metro Atlanta and Select Innovation Regions, 2008-2012



Data Source: AUTM Academic Licensing Survey
Analysis: Collaborative Economics

In 2012, Metro Atlanta institutions and the University of Georgia executed over 400 licenses, a significant (44%) jump from 2011 when the region executed 281 licenses. This upswing is a result of increased licensing activity at the University of Georgia with strong support from Emory University and the Georgia Institute of Technology. From 2008 to 2012, Metro Atlanta licensing activity nearly doubled, increasing 94 percent. Boston, the leader in total number of licenses executed, increased activity by 30 percent in the same time period. Research Triangle's licensing activity increased nine percent and Denver & Boulder's activity declined 17 percent from 2008 to 2012.[5]

Startups Spinning Out of Universities
Metro Atlanta and Select Innovation Regions, 2003-2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Metro Atlanta	14	20	15	14	19	14	17	16	17	19
Denver & Boulder	7	10	10	10	10	12	11	10	13	13
Research Triangle	10	17	9	15	8	17	9	14	16	19
Boston	32	48	51	57	60	67	51	48	73	59

Data Source: AUTM Academic Licensing Survey
Analysis: Collaborative Economics

The number of new startup companies created around discoveries generated at Metro Atlanta institutions has fluctuated between 14 and 20 over the last decade. In 2012, 19 new university startup companies were formed. This level of activity kept pace with regions such as Denver & Boulder and the Research Triangle. However, Boston area institutions spun out 59 startups in 2012, approximately three times more than Metro Atlanta and the other comparison regions.

*** Over the last five years, Metro Atlanta's university licensing activity has increased steadily.**

[5] Data for licensing and startups comes from a survey that the Association for University Technology Managers (AUTM) administers to its membership. The response rate from participating institutions is not even across innovation regions and regional information for both San Diego and Austin is not available. The University systems of Texas and California report their licensing activity across institutions so the individual contributions of UC San Diego and UT Austin cannot be extracted. For this reason, San Diego and Austin have been excluded from the analysis.

Academic Research Productivity

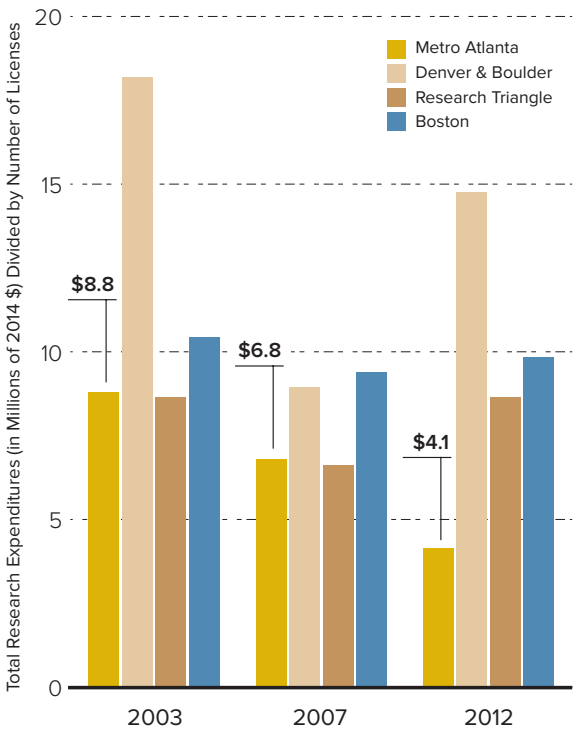
There is a direct correlation between the number of new discoveries generated by academic institutions and their research expenditures. Normalizing outputs (licenses or startups) to inputs (research dollars) shows how effectively research dollars are converted to early-stage commercialization activity.[6] Productivity can be reported as research dollars expended divided by the number of licenses executed or startups created. By this measure, lower figures signal that institutions are producing more licenses or startups per research dollar spent.

Metro Atlanta higher education institutions perform well by this measure of productivity. The ratio of research dollars spent to the number of technology licenses executed is dramatically less than other regions and continues to decline, signaling high and increasing productivity of research dollars. When university startups are normalized to research expenditures, Metro Atlanta institutions are also more productive than any of the other comparison regions, with the exception of Denver & Boulder in the most recent year.

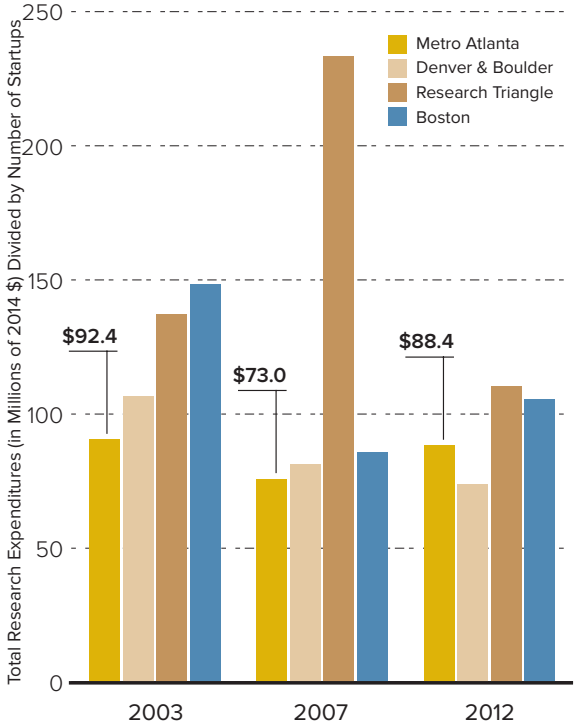
Productivity of Academic Research Dollars

Metro Atlanta* and Select Innovation Regions - 2003, 2007 and 2012

Academic Licenses



Startups Spinning Out of Universities



*Metro Atlanta includes UGA
Data Source: AUTM Academic Licensing Survey
Analysis: Collaborative Economics

[6] The AUTM survey also asks participating institutions about research expenditures. The expenditures used to normalize licensing and startup activity are from AUTM for internal consistency and are not necessarily the same as the research expenditures reported in the previous section from the National Science Foundation.

Funding for mid-stage commercialization activities is relatively low and growing slowly. Mid-stage commercialization involves activities such as prototyping and proof of concept testing. Performing these activities and converting early-stage commercialization efforts such as licensing or university startup formation into viable business opportunities often requires investment capital. There are both public and private sources of risk capital available to startups and small companies. Small Business Innovation Research and Small Business Technology Transfer (SBIR/STTR) grants are public grants awarded to small businesses by a variety of federal agencies for the purpose of advancing R&D efforts that have strong potential for commercialization. Private investors provide early-stage funding, referred to as angel, seed and series A funding, to companies in exchange for equity in the firm. Early-stage funding for startups and small companies in the Metro Atlanta region has been trending upward over the last decade but generally trails many of the other innovation regions.

Small Business Innovation Research and Small Business Technology Transfer Grants (SBIR/STTR)

Metro Atlanta has experienced the most growth of the comparison regions in SBIR/STTR funding, doubling its total award amount over the last decade. In the same time period, funding levels have declined in Boston, San Diego and Denver & Boulder. The Research Triangle and Austin have both seen increases in SBIR/STTR funding, but they are more modest in terms of total gains and growth rate. Despite these gains, Metro Atlanta trails other innovation regions in attracting SBIR/STTR funding from the federal government, receiving just $22 million in 2013, approximately one-tenth of the funding secured by companies in the Boston region.

SBIR/STTR Funding in Millions of 2013 Dollars
Metro Atlanta and Select Innovation Regions
2003, 2008 and 2013

	2003	2008	2013
Boston	$287.36	$264.51	$202.75
San Diego	$120.86	$70.91	$74.17
Austin	$23.28	$30.76	$37.53
Research Triangle	$23.81	$36.28	$27.81
Metro Atlanta	$11.30	$17.54	$22.44
Denver & Boulder	$33.15	$31.84	$19.74

Data Source: Small Business Administration
Analysis: Collaborative Economics

*** Early stage funding for startups and small companies has trended upwards over the last decade but trails many of the other innovation regions.**

Early Stage Private Investment: Angel and Seed Funding

Angel or seed funding is the initial capital used to start a company and is typically provided by individual investors. These investments are often relatively small, but can be critical in helping a company get off the ground.

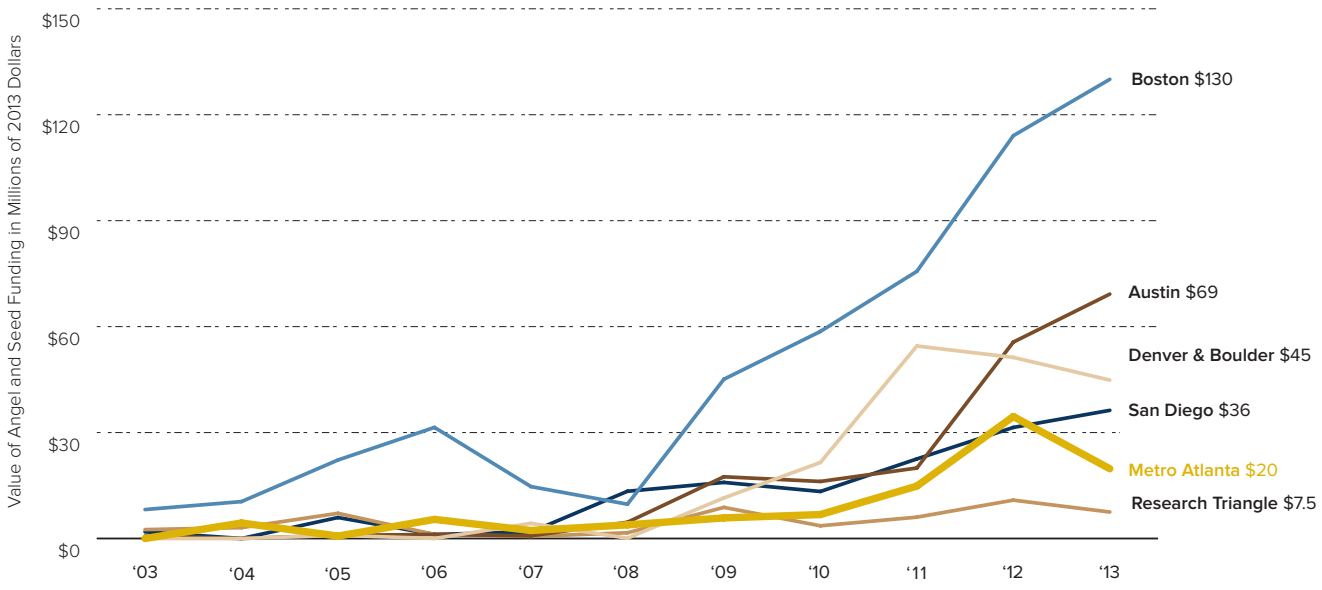
Angel and seed investment poses high risk to the investor because many early startups fail. To account for this, investments at this stage often carry more significant equity agreements, meaning that if the startup succeeds, early investors are poised to own a profitable share of the company. Due to the high risk and commensurately high rewards, investment in startup companies attracts a particular community of individuals and sometimes private firms who choose to invest in the earliest stages of a company's existence when technologies, business plans, and marketing strategies are still being formed.

Angel and seed investment in Metro Atlanta companies is lower than most other comparison regions. In 2013, Metro Atlanta companies raised $20 million of angel and seed funding. By comparison, companies in the Boston region attracted $130 million in angel and seed funding in the same year. Austin companies raised $69 million, Denver & Boulder companies, $45 million, San Diego companies, $36 million, and Research Triangle companies, $7.5 million.

Early stage funding levels for most of the comparison regions were relatively low up until 2008, but all have experienced significant growth since then. From 2008 to 2013, Metro Atlanta angel and seed funding quadrupled, Research Triangle funding grew over 3-fold, Austin increased funding 14-fold, and Boston by just over 12-fold. The most dramatic growth was in Denver & Boulder; funding went from just $80,000 in 2008 to $45 million in 2013, an almost 600-fold increase.

Angel and Seed Funding

Metro Atlanta and Select Innovation Regions, 2003-2013



Data Source: CB Insights
Analysis: Collaborative Economics

Early Stage Private Investment: Series A

Series A funding is generally the first round of investment in a company by institutional investors, such as venture capital funds, and sometimes angel networks will invest at this stage as well. In this phase, companies typically require larger amounts of capital to implement their business strategies and develop their products. Similar to angel and seed investing, series A investing is a high risk endeavor as these early-stage companies exhibit a high failure rate.

Series A venture capital investment in Metro Atlanta startups has increased over the last decade. In 2013, companies in the region raised almost $300 million in series A funding, second only to Boston, whose regional startups raised $730 million. Metro Atlanta's uptick in series A funding was largely due to a $200 million financing of Air Watch, a company that creates security software for mobile devices. However, even without the Air Watch deal, Metro Atlanta's series A funding in 2013 was significantly higher than in 2012, when regional companies attracted $25 million.

With the exception of 2013, Metro Atlanta has generally trailed the comparison regions in attracting series A investment. Boston, San Diego, Austin, and Denver & Boulder have regularly out-performed Metro Atlanta on this measure over the last decade. Cumulatively from 2003-2013, Metro Atlanta companies have attracted significantly less series A capital than regions such as San Diego and Boston, but almost twice as much as the Research Triangle.

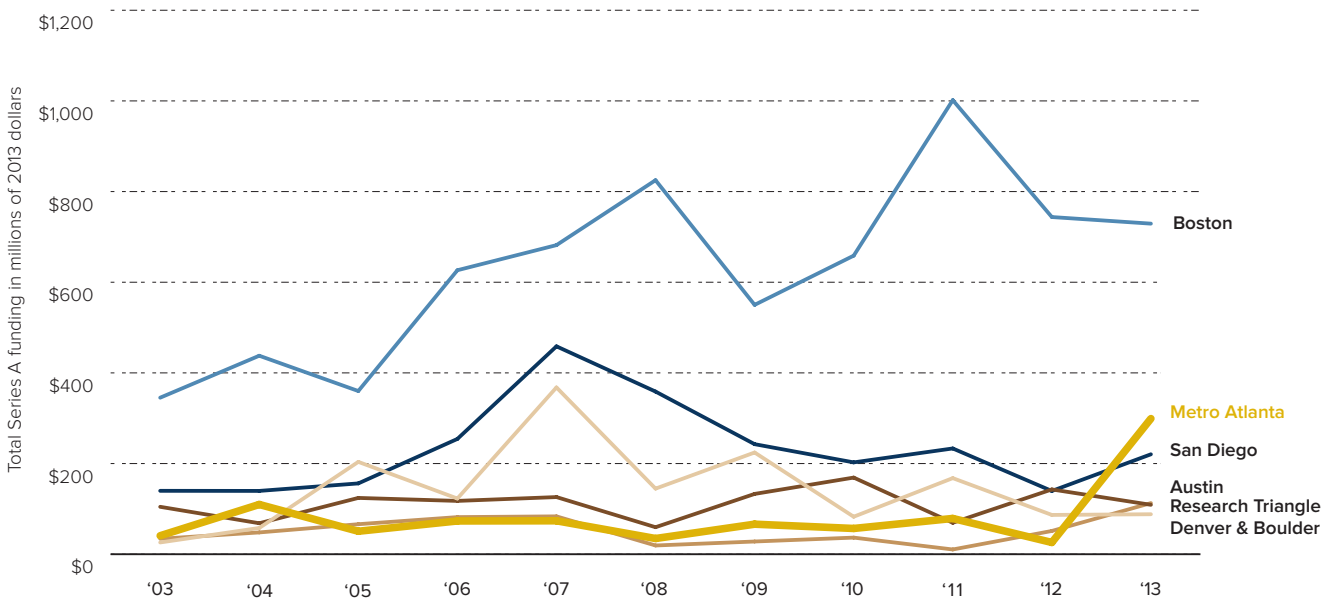
Total Series A Capital Raised* in Billions of Dollars - Metro Atlanta and Select Innovation Regions, 2003-2013

Boston	$6.96
San Diego	$2.55
Denver & Boulder	$1.57
Austin	$1.22
Metro Atlanta	$.91
Research Triangle	$.57

*In 2013 dollars

Series A Investment

Metro Atlanta and Select Innovation Regions, 2003-2013



Data Source: CB Insights
Analysis: Collaborative Economics

*** Series A investment in Metro Atlanta startups has increased over the last decade. In 2013, the region attracted almost $300 million in Series A funding, second only to Boston.**

Later Stage Investment: Venture Capital Activity

Sequential rounds of venture capital (VC) funding generally follow series A investments in startup and small companies with high growth potential. The additional capital invested supports activities such as business strategy implementation, product development and launch, expansion, and maturation to initial public offering (IPO), merger, or acquisition. Venture capital is a critical component of an innovation economy because it provides risk capital to high-tech and other innovative companies that cannot access the public markets or secure more traditional financing such as bank loans. The investors, or venture capitalists, trade high risk financing for equity in the company, which can generate high returns if the company is successful.

Often times, venture capitalists also provide important leadership to the companies in which they invest and connect them to other key elements of the innovation economy, such as additional investors and business services. The availability of local venture capital and the ability of a region to secure outside VC is an important element in attracting and retaining entrepreneurial talent as well as attracting young, educated adults.[7]

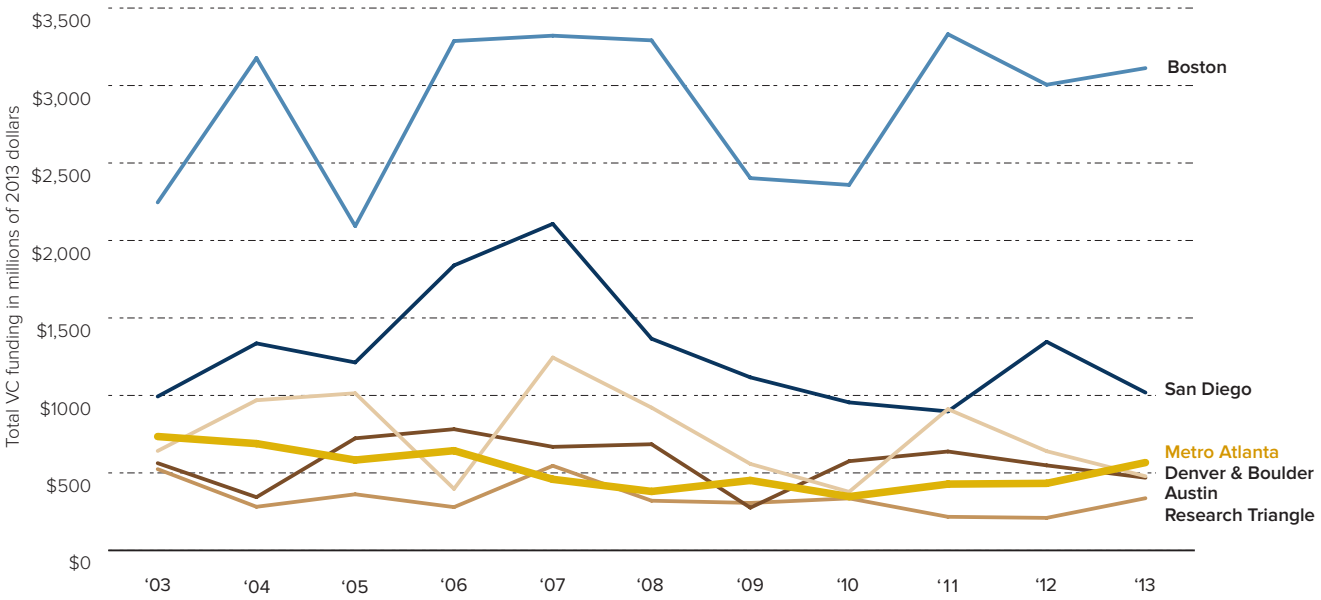
Over the last decade, the level of VC funding in Metro Atlanta has declined 23 percent. Metro Atlanta companies attracted $570 million (not including angel or seed) in 2013, down from $730 million in 2003. Several other comparison regions also experienced a decline in VC funding, including Denver & Boulder (-25%), Austin (-17%), and the Research Triangle (-36%). VC in Boston and San Diego has grown over the last decade. Boston companies raised over $3 billion in VC in 2013, a 39 percent increase from 2003. San Diego raised just over $1 billion in 2013, three percent more than in 2003.

In 2013, Metro Atlanta raised nearly $570 million in VC, placing it behind Boston and San Diego in the comparison cohort. Since hitting a decade low of $347 million in VC funding in 2010, Metro Atlanta has rebounded by 67 percent, more than any of the other comparison regions in the same time period. Between 2010 and 2013, VC funding grew 32 percent in Boston, 27 percent in Denver & Boulder, seven percent in San Diego, and dropped 19 percent in Austin. Research Triangle saw virtually no net growth or decline in VC between 2010 and 2013.

*** Later-stage commercialization activities reveal a soft market for venture capital, but an evolution in other forms of finance.**

VC Investment

Metro Atlanta and Select Innovation Regions, 2003-2013



Data Source: CB Insights
Analysis: Collaborative Economics

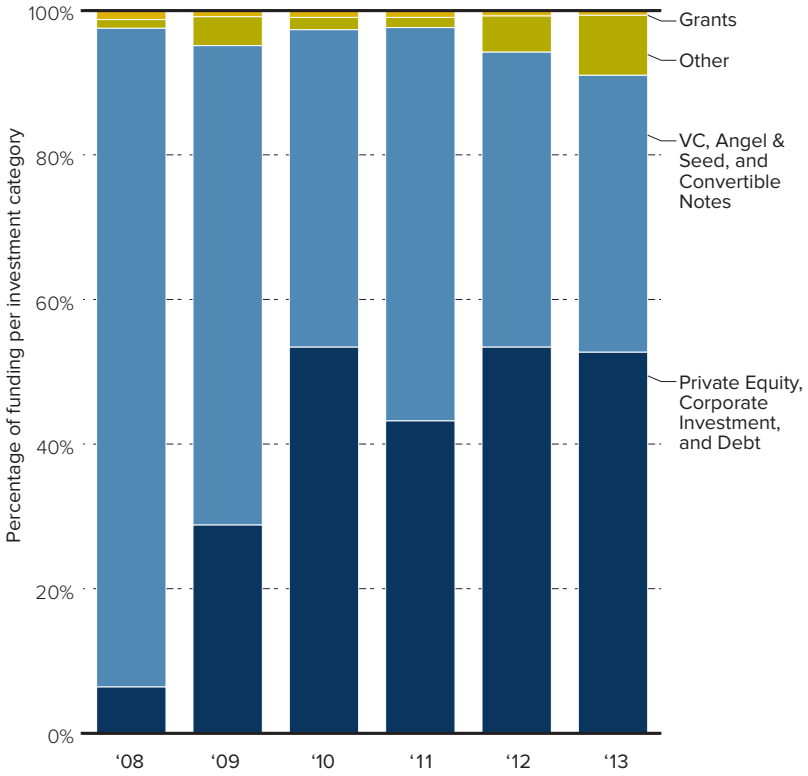
[7] Florida, Richard. "High-School Dropouts and College Grads Are Moving to Very Different Places." City Lab. June 14, 2014. http://www.citylab.com/work/2014/06/high-school-dropouts-and-college-grads-are-moving-to-very-different-places/372065/ (accessed July 1, 2014).

Other Forms of Financing

Venture capital funding is an important metric for assessing the risk capital available for startup companies in a region, but more mature companies also rely on other forms of private financing. Debt, private equity, and corporate investment are some of the financing mechanisms available to companies that are more established, and in the case of debt, have real assets to put up as collateral. These types of financing are typically associated with lower risk deals, meaning that investors judge the companies to be high quality or reliably viable. The presence of later-stage financing activity signals that the region is producing companies that overcome early-stage hurdles such as developing a business strategy, raising early stage capital, and attracting a customer base. In 2013, over half of the $1.5 billion in private funds invested in Metro Atlanta companies ($790 million) were in the form of private equity, corporate and debt investments. In comparison, Metro Atlanta companies raised $574 million in VC, angel, seed, and convertible note funding, with the remaining $136 million in undisclosed private investment rounds.

Funding Sources

Metro Atlanta, 2008-2013



Data Source: CB Insights
Analysis: Collaborative Economics

*** In 2013, over half of the private funds invested in Metro Atlanta companies were in the form of private equity, corporate and debt investments.**

Total Private Investment

Funding for startup companies at all stages is a critical measure of innovation capacity. As discussed in previous sections, each stage of financing serves different purposes in the life of a startup, and according to the risk associated with each stage, investment arrangements vary. Total private investment includes all forms of private financing (including debt) and summarizes the magnitude of a region's ability to attract investment dollars.

Metro Atlanta's total private investment trails Boston, San Diego, and Denver & Boulder, but exceeds Austin and Research Triangle. In 2013, Metro Atlanta companies attracted approximately $1.5 billion in private investment while Boston area companies raised just under $4.5 billion. Denver & Boulder raised $2.3 billion and San Diego raised $1.6 billion in total private investment. Austin and Research Triangle brought in $850 million and $560 million, respectively.

Since 2003, Metro Atlanta has nearly doubled (+93%) the total private investment flowing into the region. In the same time period, Denver & Boulder saw a 136 percent gain and Boston a 94 percent gain. Austin's total private investment increased 51 percent and San Diego increased private financing by 64 percent. Research Triangle's private investment level decreased over the last decade by 31 percent.

In 2013, the average deal size in Metro Atlanta was almost $9.5 million, while Boston and San Diego's were $6.7 and $7.0 million, respectively. Large deal size is another indicator that investment in Metro Atlanta is directed to more mature companies. Mature companies with developed products and markets typically pose lower risk to investors, and these companies may also require large cash infusions to break new ground. Both of these factors can contribute to investment deals that involve more capital.

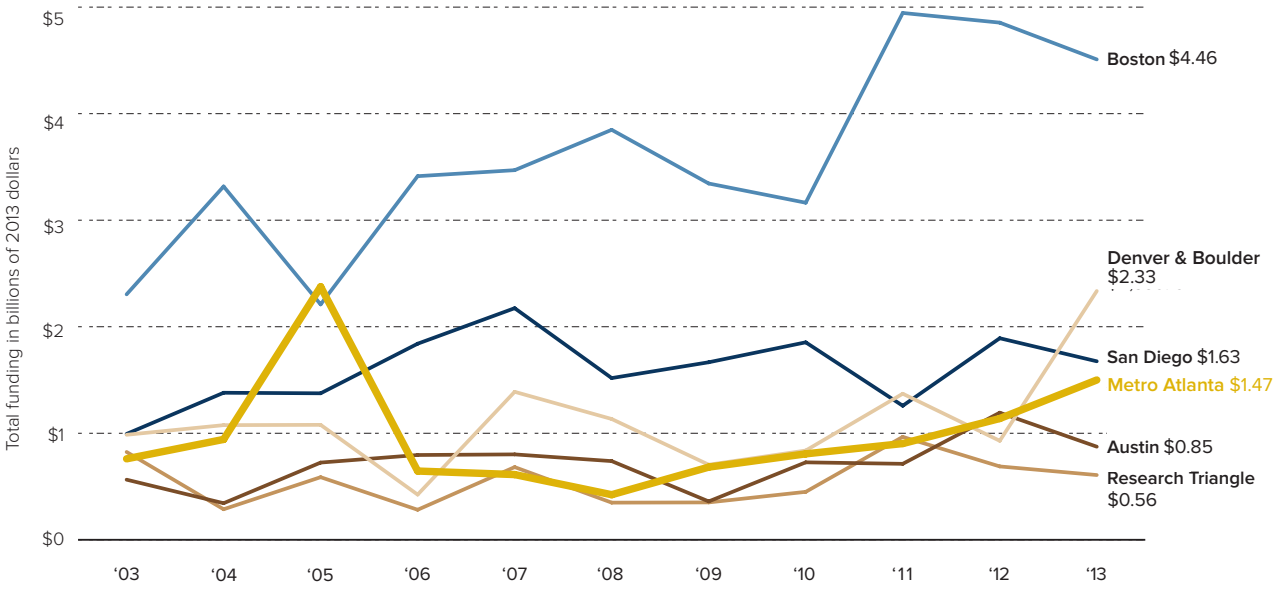
Average Deal Size*
Metro Atlanta and Select Innovation Regions, 2013

Region	Millions of Dollars
Metro Atlanta	$9.43
Denver & Boulder	$8.49
San Diego	$7.01
Boston	$6.73
Austin	$3.97
Research Triangle	$3.90

*Excludes M&As and IPOs, includes debt

*** Metro Atlanta has the largest average deal size of all the comparison regions despite trailing Boston, San Diego and Denver & Boulder in total private investment.**

Total Private Investment*
Metro Atlanta and Select Innovation Regions, 2003-2013



*Total private investment does not include IPO or M&A deals.
Data Source: CB Insights
Analysis: Collaborative Economics

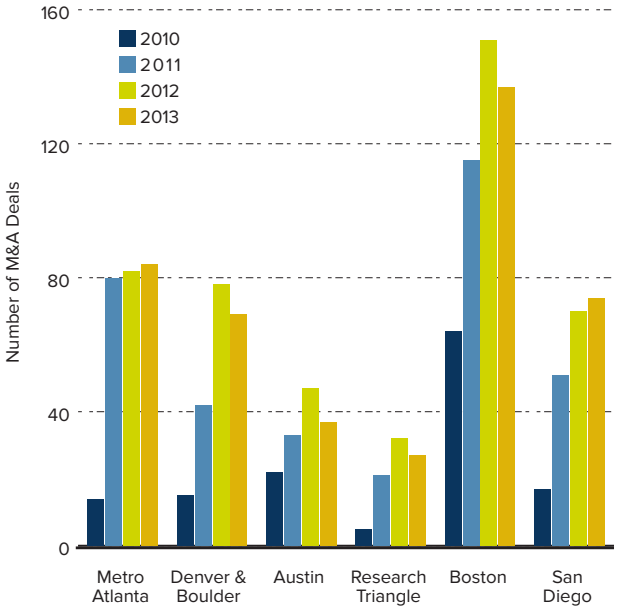
Initial Public Offerings (IPOs) and Mergers and Acquisitions (M&As)

The process of a company entering the public stock market, through an IPO, or merging with or being acquired by a larger firm (M&A) signals a certain level of maturity for a company and the viability of its business model. Both events, IPOs and M&As, are typically deemed "exits" by investors. Metro Atlanta companies compete well with other innovation regions in terms of exit activity. For many large, established firms, acquisitions of smaller companies represent a way of externalizing research and market risk. By allowing young companies to prove their technologies or business models using a pool of investors, larger, anchor firms can share the burden of risk capital for new products with outside investors.

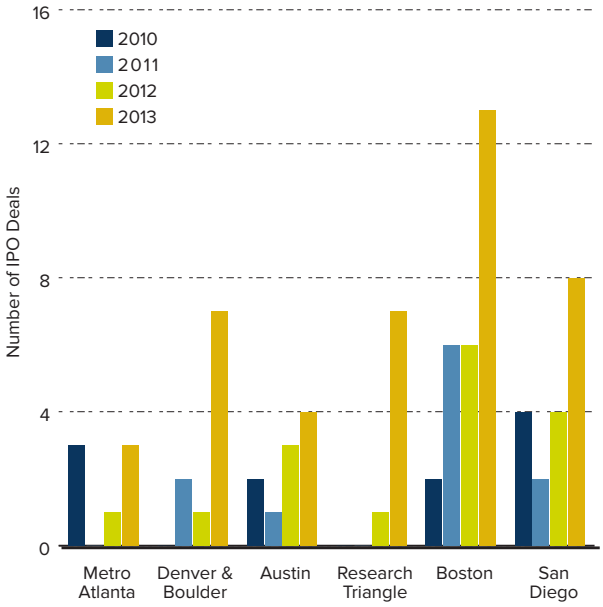
M&As and IPOs also provide other benefits to the innovation economy. They often result in cash pay outs for early investors and stakeholders, including early employees and founders. The employees who exit a company after an acquisition or IPO have also likely gained valuable experience commercializing technology, giving them important skills to contribute to their next venture. Capital and experience are released into the community, providing funding and talent for new ventures. Metro Atlanta performs well relative to the other comparison regions in overall exit activity, and is second only to Boston in M&A activity in recent years.

In 2013, 84 Metro Atlanta companies merged with or were acquired by other firms and three companies went public. Metro Atlanta's M&A activity was strong coming out of the recession as well, with 80 M&As in 2011 and 82 in 2012. The average number of M&As per year between 2010 and 2013 in Metro Atlanta was 65, compared with 117 in Boston, 53 in San Diego, 51 in Denver & Boulder, 35 in Austin, and 21 in the Research Triangle.

Mergers & Acquisitions Activity
Metro Atlanta and Select Innovation Regions, 2010-2013



IPO Activity
Metro Atlanta and Select Innovation Regions, 2010-2013

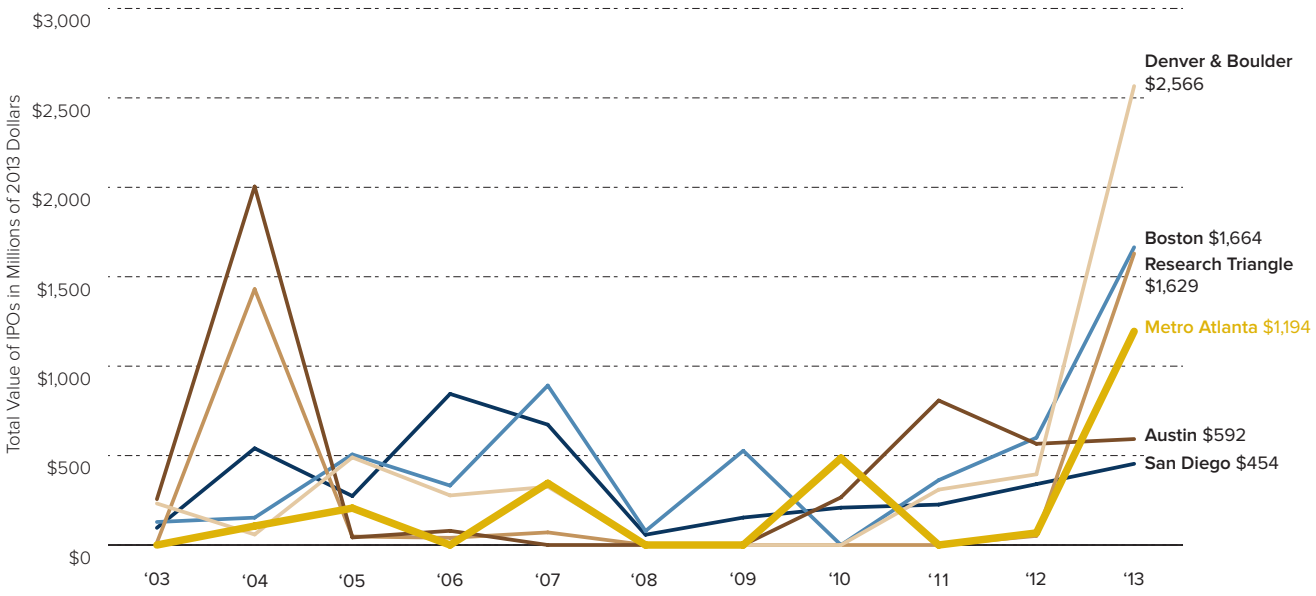


Data Source: CB Insights
Analysis: Collaborative Economics

IPOs are an important milestone for a company, providing entrepreneurs and investors an opportunity to earn a return on their investment and reinvest in other companies. In addition, IPOs open the company to additional investors and provide a new platform for raising additional funds. Variability in IPO valuations across years can be high because the range of values from deal to deal is generally large and the number of IPOs occurring each year for any one region is typically low. In 2013, the largest Metro Atlanta IPO was HD Supply Holding, which went public at almost $1 billion. Total IPO valuation in 2013 for Metro Atlanta was significantly higher than in previous years. Denver & Boulder led the comparison regions in IPO valuation in 2013. Two oil and gas IPOs, Antero Resources Corporation and QEP Midstream Partners, had a combined value of $2 billion, pushing the region far beyond its competitors with a total IPO valuation of $2.6 billion. IPO valuations in both Boston and the Research Triangle totaled $1.6 billion in 2013, and Austin and San Diego trailed the other regions with IPO valuations at $590 million and $450 million, respectively.

Total IPO Valuation

Metro Atlanta and Select Innovation Regions, 2003-2013



Data Source: CB Insights
Analysis: Collaborative Economics

Metro Atlanta Local M&A Activity

Strong M&A activity is a sign of a healthy innovation economy. It means that local companies are attracting buyers because they are creating value. However, it is not clear if the many large companies headquartered in the Metro Atlanta region are connecting with local startups. In a robust innovation ecosystem where all facets of the economy are connected—the research assets, the startup companies, and the anchor firms—there is often a strong acquisition connection between anchor firms and startup businesses. Data from Crunchbase[8], a crowd sourced database on startup activity, suggests that the companies acquiring firms developed in the Metro area are primarily from outside of Georgia. This is not necessarily a bad thing, but it does pose the question of how connected the startup activity in Metro Atlanta is with its strong anchor firms that drive the economy.

In 2013, Crunchbase counted 11 Metro Atlanta startups that were acquired, all by companies outside of Georgia. In 2011, where the most deals were reported, only 11 percent of the Metro Atlanta acquisitions involved a Georgia-based buyer. While this dataset is not as extensive as the CB Insights data in the previous section, it does suggest that when Metro Atlanta startups reach maturity, it is not the region's core of large, anchor firms that are acquiring them. However, this data does not negate the possibility that firms acquired remain in the Metro Atlanta region and contribute to its economy, despite their acquirers residing elsewhere.

The same dataset shows that Metro Atlanta firms are actively acquiring companies, signaling that the core anchor firms are procuring innovation through the purchase of startup firms. As detailed in the section above, acquiring startups is a way for established businesses to innovate while externalizing risk. The Crunchbase data shows that Metro Atlanta companies are actively being acquired and that Metro Atlanta anchor firms are buying companies, but within this dataset, it does not appear that these connections are happening locally.

Who is Buying Atlanta Startups?
Georgia, United States (Not GA) and International, 2007-2013

	Headquarters of Companies Buying Atlanta Startups			
	GA	U.S.	Int'l	Total Deals
2007	13%	75%	13%	8
2008	21%	58%	21%	19
2009	14%	50%	36%	14
2010	13%	38%	50%	16
2011	11%	67%	22%	27
2012	11%	72%	17%	18
2013	0%	82%	18%	11

Are Atlanta Firms Acquiring Startups?
Number of Acquisitions made by Atlanta Companies 2007-2013

	# of Acquisitions
2007	4
2008	16
2009	21
2010	18
2011	34
2012	36
2013	26

Data Source: Crunchbase
Analysis: Collaborative Economics

*** Local merger and acquisition activity data may suggest that Metro Atlanta anchor firms are not connecting with Metro Atlanta startups.**

[8] Crunchbase data is different from the CB Insights data in the previous exits section. While CB Insights is meant to be a census, or complete accounting for investment deals, Crunchbase is based on a crowdsourced survey of merger and acquisition activity and provides a different level of detail. The number of M&As it counts are significantly less than CB Insights so conclusions must be drawn accordingly. Startup companies in the Crunchbase M&A data are generally those that are pre-IPO and have received early-stage investment such as angel and/or VC.

Metro Atlanta has a large innovation employment sector, but lags other innovative regions in concentration and wages. A well-functioning innovation economy is an ecosystem of academia, business, and government working together to connect people, ideas, and capital. The result of this system is a thriving regional economy with growing innovation sectors. Jobs in innovation-based industries are important because they pay higher than average wages and are growing faster than many traditional industries. These jobs are also important because for now, the United States has an edge on other global markets when it comes to knowledge-based industries and talent. Jobs in these industries are less vulnerable to being exported to lower wage countries.

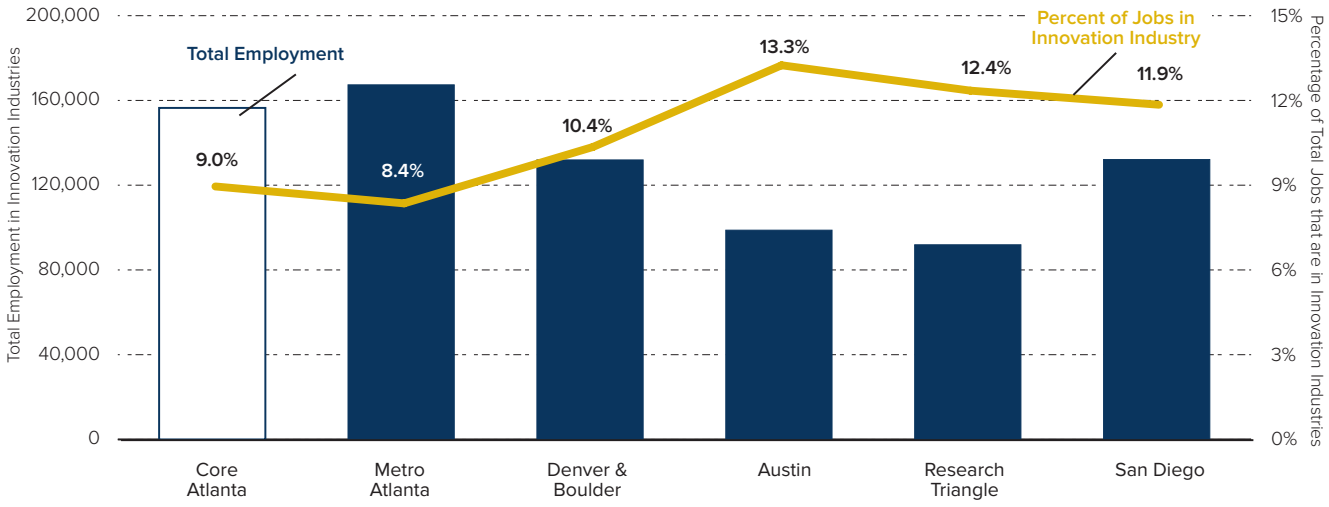
Employment in Innovation-Based Industries

Atlanta has many jobs in innovation-based industries[9], but the concentration of these industries is not as robust as other innovation regions. The geographic concentration of economic activity in a particular industry sector or sectors, such as innovation industries, is an important variable in the long-term growth of the sector.[10] For instance, while Metro Atlanta has twice as many innovation-based industry jobs than Austin, relative to the size of each regional economy, Austin's concentration of those jobs is nearly 75 percent higher than in Metro Atlanta. Metro Atlanta has a sizeable presence of innovation industries, but their relative concentration is weaker than other regions, which may be a factor in innovation industry performance over the last decade.

*** Employment in innovation-based industries is high, yet concentration is low.**

Innovation Industry Employment

Metro Atlanta and Select Innovation Regions*, 2012



* Census QWI Indicators not available for the state of Massachusetts, Boston data not available.
Data Source: US Census, Quarterly Workforce Indicators
Analysis: Collaborative Economics

[9] See Appendix for innovation-based industry definition.
[10] Krugman, Paul. *Geography and Trade*. Cambridge: MIT Press, 1993.

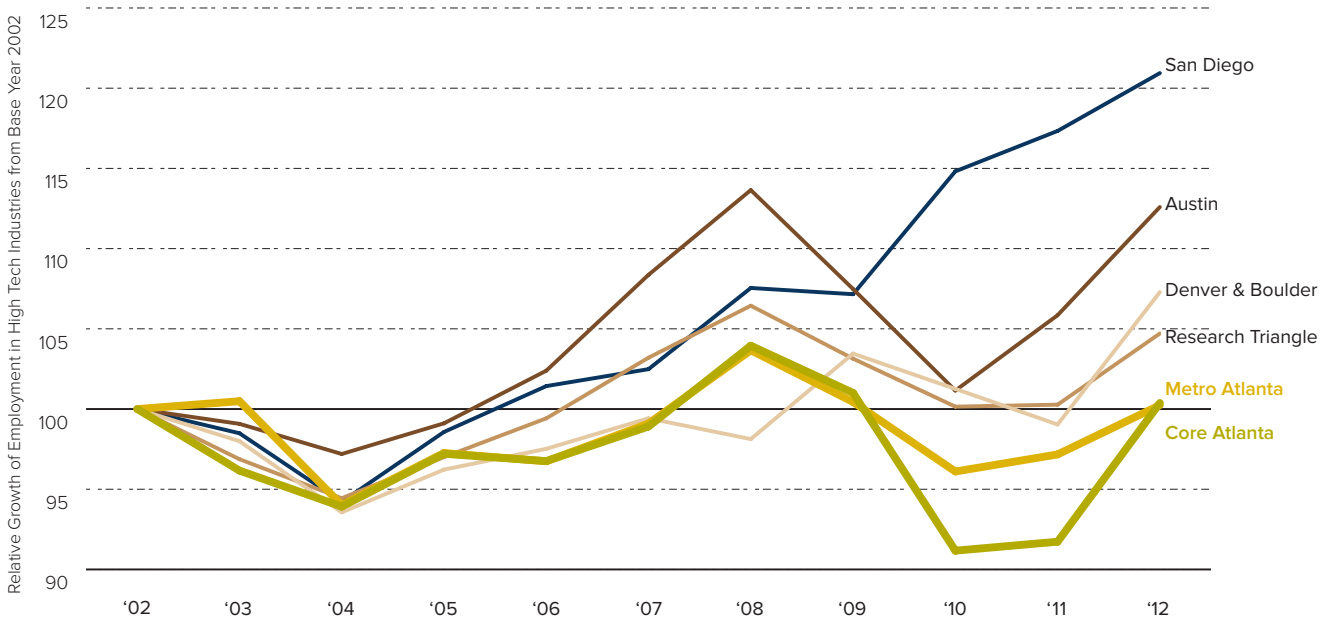
In 2012, there were more than 160,000 jobs in innovation industries in Metro Atlanta, most of which were located in Core Atlanta. The concentration of these jobs within the region was nine percent in Core Atlanta and 8.4 percent in Metro Atlanta. Austin and the Research Triangle had the fewest number of jobs in innovation industries (99,000, and 92,000 jobs, respectively), but the highest concentration of jobs (13.3% and 12.4%).

Perhaps indicative of its lower concentration of jobs and the relative power of its innovation industries, Metro Atlanta is not creating jobs in innovation based-industries as quickly as other innovation regions. Over the last decade, jobs in innovation-based industries have fluctuated in Metro and Core Atlanta, with a net gain of only 500 since 2002. Employment in other regions has also fluctuated, but all have gained substantially more total jobs over the 2002-2012 time period. San Diego has 22 percent more jobs in innovation industries than a decade ago and Austin has 13 percent more jobs. Denver & Boulder and the Research Triangle have also made gains, adding seven and five percent more jobs over the decade. In real numbers this translates to 23,000 more jobs in San Diego, 11,000 more jobs in Austin, 9,000 more jobs in Denver & Boulder, and 4,000 more jobs in the Research Triangle.

During the recent recession, the dip in innovation industry jobs in Metro Atlanta was significantly deeper than other cities. From 2008 to 2010, Metro Atlanta's innovation industries shrunk seven percent and Core Atlanta's innovation industries shrunk 12 percent. Austin was also deeply affected, seeing its innovation industries contract 11 percent. Denver & Boulder and San Diego both managed to post growth over the two year period; Denver & Boulder's innovation industries grew three percent and San Diego seven percent.

Employment Growth in Innovation Industries

Metro Atlanta and Select Innovation Regions, 2002-2012



Data Source: US Census, Quarterly Workforce Indicators
Analysis: Collaborative Economics

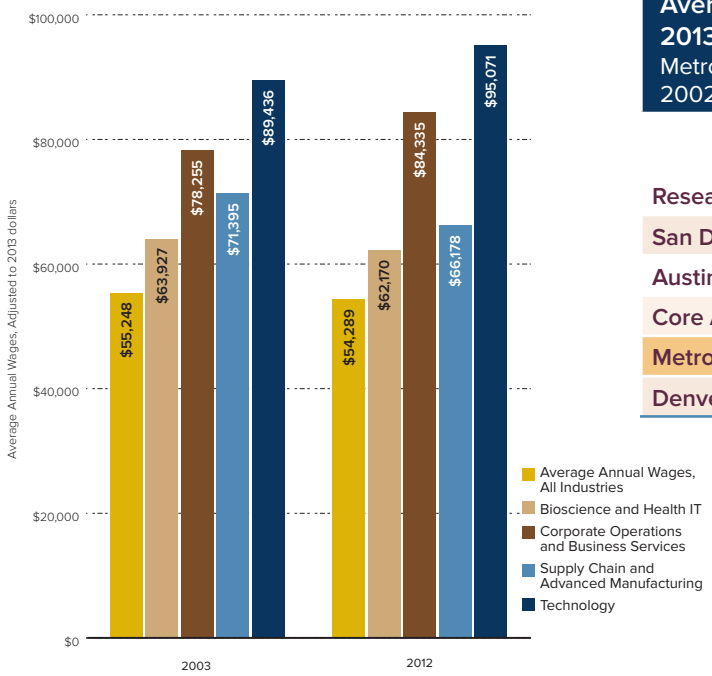
Wages

Another important competitiveness measure is the average wage of innovation-based industries. Metro Atlanta's average wage in these industries trails the Research Triangle, San Diego and Austin. In 2012, the average annual wage in the innovation industries was just over $96,000 in Metro Atlanta, compared to $115,000 in the Research Triangle, $112,000 in San Diego, and $111,000 in Austin. Denver & Boulder's average wage was $93,000. While cost of living impacts wages, growth of real wages is also slower in Metro Atlanta than the comparison regions.

Between 2002 and 2012, innovation industry salaries grew approximately five percent in real dollars in the Metro and Core Atlanta areas, the least of all the comparison regions. A breakout analysis of Atlanta's industry clusters show that real wages have fallen over the last decade in Bioscience (-3%), Supply Chain and Advanced Manufacturing (-7%), while Technology jobs have seen a modest six percent gain from approximately $90,000 a year in 2003 to $95,000 in 2012.

Average Annual Wage by Cluster

Metro Atlanta, 2003 and 2012



Data Source: US Census, Quarterly Workforce Indicators
Analysis: Collaborative Economics

Average Innovation Industry Salaries in 2013 Dollars
Metro Atlanta and Select Innovation Regions
2002 and 2012

	2002	2012	% Change 2002-2012
Research Triangle	$104,266	$115,486	10.76%
San Diego	$83,566	$112,022	34.05%
Austin	$98,717	$111,264	12.71%
Core Atlanta	$93,868	$99,273	5.76%
Metro Atlanta	$91,632	$96,363	5.16%
Denver & Boulder	$84,000	$92,793	10.47%

* **In 2012, the average annual wage in Metro Atlanta's innovation industries was just over $96,000.**

Conclusion

Taken together, the indicators in this report provide insight into the innovation capacity of Metro Atlanta. Evaluating the region's ability to attract, create and retain key elements that comprise an innovation ecosystem is an important step in its preparation to compete in future economic landscapes. Innovation capacity is a broad concept, which is why this project examines a series of indicators to provide insight into the region's current innovation landscape relative to its own history, and to benchmark it against other leading innovation regions. While no set of indicators completely captures the workings of a regional economy, this analysis offers many reasons to be excited about the future of innovation-based industries in Metro Atlanta, as well as some areas in which growth is critical.

Metro Atlanta's innovation capacity is strong; robust innovation resources and a local community of global companies make the region a prime candidate for talent and capital. Metro Atlanta's population of adults with a bachelor's degree or higher is growing in total numbers and in percentage of the total population. These educated adults are finding work in growing numbers of high-tech jobs. Academic research institutions are extremely productive; expenditures on R&D and licenses executed are growing. Anchoring the innovation sector, Metro Atlanta's total employment in innovation-based industries, including technology and bioscience, is large compared to other innovation regions and reached approximately 160,000 jobs in 2012.

However, ensuring that Metro Atlanta's solid early-stage innovation activity—research, intellectual property, licensing, and startups—translates into innovation industries is key to fully leverage the significant amount of academic R&D generated every year. Attracting more capital for early-stage investment in young companies will move more innovative ideas forward. Additionally, slow job growth and low concentration of innovation industries may be defining factors in losing talent and investors to other locales.

The challenge for the Metro Atlanta region in the coming years is to connect its innovation assets to the startup and anchor firms that are the base of the innovation economy. It is this connectivity or "brokerage" of information, services, and capital that define a strong innovation ecosystem. A long-term effect of the functional innovation economy is that its products—wealth, businesses, knowledge, jobs, networks, and brokers—grow with time.

Supporting efforts to create and reinforce the bonds, networks, and resources that promote the successful commercialization of ideas and research is a critical next step to increase Metro Atlanta's innovation capacity. Working with partners across the region to pursue a common strategy that focuses on leveraging Metro Atlanta's innovation assets is already in process. New ventures like Startup Atlanta, a neutral entity whose interest is to strengthen the ecosystem, and the Metro Atlanta Chamber with their partners at Invest Atlanta, industry associations and academic institutions are already working together to connect the various parts of Atlanta's innovation economy. It is in support of this work that the innovation indicators were commissioned and can be used to measure progress, track success, and decide on areas for action.

Appendix

Population growth by education
Data for educational attainment are from the United States Census Bureau, American Community Survey, 2005-2012. Survey data capture the education attainment of adults over 25 years old in a given area. Data is for the Atlanta-Sandy Springs-Marietta, GA Metro Area, the Boston-Cambridge-Quincy, MA-NH Metro Area, the Austin-Round Rock-San Marcos, TX Metro Area, Denver and Boulder (Denver-Aurora-Boulder, CO Combined Statistical Area which includes the Greeley Metro Area), Research Triangle (Durham-Chapel Hill, NC Metro Area, Raleigh-Cary, NC Metro Area), and the San Diego-Carlsbad-San Marcos, CA Metro Area.

Total R&D 2012
Data are from the National Science Foundation (NSF) Academic R&D expenditures survey and are captured by institution. Data used are the totals for all R&D, Federal, FFRDCs, Business, U&C and Other Nonprofit. Data for fiscal year 2012 comes from Higher Education Research and Development Survey Fiscal Year 2012, Table 4. Higher education R&D expenditures, ranked by all R&D expenditures, by source of funds. Historical data come from Higher Education Research and Development: Fiscal Year 2011, TABLE 13: Higher education R&D expenditures, ranked by FY 2011 R&D expenditures: FY 2004–11 and TABLE 16: Federally financed higher education R&D expenditures, ranked by FY 2011 R&D expenditures: FY 2004–11.

Angel and seed funding 2013
Investment data are provided by CB Insights (www.cbinsights.com) and includes disclosed investment deals in more than 80,000 private companies.

Employment in innovation industries 2012
The Quarterly Workforce Indicators (QWI) provide local labor market statistics by industry, worker demographics, employer age and size. The QWI source data are unique job-level data that link workers to their employers. The source data for the QWI is the Longitudinal Employer-Household Dynamics (LEHD) linked employer employee microdata. The LEHD data is massive longitudinal database covering over 95% of U.S. private sector jobs. Much of this data is collected via a unique federal-state data sharing collaboration, the Local Employment Dynamics (LED) partnership. LED is a cooperative venture between the LEHD program at the U.S. Census Bureau and state agencies of all 50 states, the District of Columbia, Puerto Rico, and the U.S. Virgin Islands. Data for Massachusetts, Puerto Rico, and the US Virgin Islands are under development. A wide variety of record sources contribute to the construction of the QWI, including the administrative records on employment collected by the states, Social Security data, Federal tax records, and other census and survey data. Industry data is available at the 4-digit NAICS level. Innovation Industries are based on the BLS definition of high-tech NAICS industries, but include additional scientific industries.

Population of innovation regions table

Population data comes from the United States Census Population Estimate, County Totals dataset. Comparison regions are defined by their 2012 Metro area and backcast using county populations for the years 2003-2013. The Metro Atlanta is defined (in the population table) by its 2013 Metro Area - the Atlanta-Sandy Springs-Roswell metro - and backcast using county populations for the years 2003-2013. Metro definitions by county are as follows:

Metro Atlanta *Atlanta-Sandy Springs-Roswell, GA Metro Area*	**Denver & Boulder** *Greeley, Boulder and Denver-Aurora-Broomfield, CO Metro Areas*	**Research Triangle** *Durham-Chapel Hill and Raleigh-Cary Metro Areas*
Barrow County	Adams County	Chatham County
Bartow County	Arapahoe County	Durham County
Butts County	Boulder County	Franklin County
Carroll County	Broomfield County	Granville County
Cherokee County	Clear Creek County	Harnett County
Clayton County	Denver County	Johnston County
Cobb County	Douglas County	Lee County
Coweta County	Elbert County	Orange County
Dawson County	Gilpin County	Person County
De Kalb County	Jefferson County	Vance County
Douglas County	Park County	Wake County
Fayette County	Weld County	
Forsyth County		
Fulton County	**San Diego** *San Diego-Carlsbad-San Marcos, CA Metro Area*	**Boston** *Boston-Cambridge-Quincy, MA-NH Metro Area*
Gwinnett County		
Haralson County	San Diego County	Essex County
Heard County		Middlesex County
Henry County	**Austin** *Austin-Round Rock-San Marcos, TX Metro Area*	Norfolk County
Jasper County		Plymouth County
Lamar County	Bastrop County	Suffolk County
Meriwether County	Caldwell County	Rockingham County
Morgan County	Hays County	Strafford County
Newton County	Travis County	
Paulding County	Williamson County	
Pickens County		
Pike County		
Rockdale County		
Spalding County		
Walton County		

Adult Population Education and Change in Population

Data for educational attainment are from the United States Census Bureau, American Community Survey, 2005-2012. Survey data capture the education attainment of adults over 25 years old in a given area. Data is for the Atlanta-Sandy Springs-Marietta, GA Metro Area, the Boston-Cambridge-Quincy, MA-NH Metro Area, the Austin-Round Rock-San Marcos, TX Metro Area, Denver and Boulder (Denver-Aurora-Boulder, CO Combined Statistical Area which includes the Greeley Metro Area), Research Triangle (Durham-Chapel Hill, NC Metro Area, Raleigh-Cary, NC Metro Area), and the San Diego-Carlsbad-San Marcos, CA Metro Area.

STEM Graduates

National and regional data for 2002-2012 are from the National Center for Education Statistics, Integrated Post Secondary Data System (IPEDS). The academic disciplines include: computer and information sciences, engineering, engineering-related technologies, biological sciences/life sciences, mathematics, physical sciences and science technologies. Data were analyzed based on 1st major, citizenship, and level of degree (bachelors, masters or doctorate). Institutions reporting to IPEDS in the Metro Atlanta and comparison innovation regions are as follows:

Atlanta	Denver and Boulder	Boston
State University of West Georgia	ITT Technical Institute (Aurora, CO)	College for Lifelong Learning
Reinhardt College	Colorado Institute of Art	University of New Hampshire
Clayton State College	University of Colorado at Denver	Merrimack College
Life College	University of Denver	Endicott College
Southern Polytechnic State University	Metropolitan State College of Denver	Salem State College
Kennesaw State University	Denver Institute of Technology	Gordon College (Wenham, MA)
Agnes Scott College	Regis University	Framingham State College
DeVry Institute of Tech (Decatur, GA)	Denver Technical College	University of Massachusetts Lowell
Oglethorpe University	Colorado Christian University	Harvard University
Emory University	University of Colorado Health Sciences Center	Lesley College
Georgia State University	Colorado School of Mines	Massachusetts Institute of Technology
Herzing College of Business and Technology	University of Colorado at Boulder	Tufts University
Morehouse College of Medicine	University of Northern Colorado	Eastern Nazarene College
Clark Atlanta University		Curry College
Morehouse College		Bridgewater State College
Morris Brown College		Suffolk University
Spelman College		Emmanuel College (Boston, MA)
Art Institute of Atlanta		Massachusetts College of Phar & Allied Hlth Sci
The American College in Atlanta		New England College of Optometry
Georgia Institute of Technology, Main Campus		Northeastern University
Gordon College (Barnesville, GA)		Simmons College
University of Georgia		Wentworth Inst of Tech
		Franklin Institute of Boston
		University of Massachusetts at Boston
		Boston University
		Wheelock College

Research Triangle	Austin	San Diego
Duke University	Southwest Texas State University	Christian Heritage College
North Carolina Central University	Huston-Tillotson College	University of California-San Diego
Campbell University	St Edward's University	California State University-San Marcos
University of North Carolina at Chapel Hill	Concordia University at Austin	Point Loma Nazarene College
Peace College	University of Texas at Austin	National University
Meredith College	ITT Technical Institute (Austin, TX)	University of San Diego
St Augustine's College	Southwestern University	California School Prof Psych at San Diego
Shaw University		San Diego State University
North Carolina State University at Raleigh		

Concentration of High-tech Occupations

The U.S. Bureau of Labor Statistics, Occupational Employment Estimates (OES) program estimates the number of people employed in certain occupations and wages paid to them. The OES data include all full-time and part-time wage and salary workers in non-farm industries. Self-employed persons are not included in the estimates. The OES uses the Standard Occupational Classification (SOC) system to classify workers. The occupations defined as High-tech are as follows:

SOC Code	Occupation	SOC Code	Occupation
11-3021	Computer and information systems managers	17-2151	Mining and geological engineers, including mining
11-9041	Engineering managers	17-2161	Nuclear engineers
11-9121	Natural sciences managers	17-2171	Petroleum engineers
15-1111	Computer and information scientists, research	17-3011	Architectural and civil drafters
15-1122	Computer systems analysts	17-3012	Electrical and electronics drafters
15-1131	Computer programmers	17-3013	Mechanical drafters
15-1132	Computer software engineers, applications	17-3021	Aerospace engineering and operations technicians 52,500
15-1133	Computer software engineers, systems	17-3022	Civil engineering technicians
15-1141	Database administrators	17-3023	Electrical and electronic engineering technicians
15-1142	Network and computer systems administrators	17-3024	Electromechanical technicians
15-1143	Network systems and data communications	17-3025	Environmental engineering technicians
15-1151	Computer support specialists	17-3026	Industrial engineering technicians
15-2011	Actuaries	17-3027	Mechanical engineering technicians
15-2021	Mathematicians	17-3031	Surveying and mapping technicians
15-2031	Operations research analysts	19-1011	Agricultural and Food Scientists
15-2041	Statisticians	19-1021	Biochemists and biophysicists
15-2091	Mathematical technicians	19-1022	Microbiologists
17-2011	Aerospace engineers	19-1023	Zoologists and wildlife biologists
17-2021	Agricultural engineers	19-1031	Conservation scientists
17-2031	Biomedical engineers	19-1032	Foresters
17-2041	Chemical engineers	19-1041	Epidemiologists
17-2051	Civil engineers	19-1042	Medical scientists, except epidemiologists
17-2061	Computer hardware engineers	19-2011	Astronomers
17-2071	Electrical engineers	19-2012	Physicists
17-2072	Electronics engineers, except computer	19-2021	Atmospheric and space scientists
17-2081	Environmental engineers	19-2031	Chemists
17-2111	Health and safety engineers, except mining safety	19-2032	Materials scientists
17-2112	Industrial engineers	19-2041	Environmental scientists and specialists,
17-2121	Marine engineers and naval architects	19-2042	Geoscientists, except hydrologists and
17-2131	Materials engineers	19-2043	Hydrologists
17-2141	Mechanical engineers	19-4011	Agricultural and food science technicians

R&D

Data are from the National Science Foundation (NSF) Academic R&D expenditures survey and are captured by institution. Data used are the totals for all R&D, Federal, FFRDCs, Business, U&C and Other Nonprofit. Data for fiscal year 2012 comes from Higher Education Research and Development Survey Fiscal Year 2012, Table 4. Higher education R&D expenditures, ranked by all R&D expenditures, by source of funds. Historical data come from Higher Education Research and Development: Fiscal Year 2011, TABLE 13: Higher education R&D expenditures, ranked by FY 2011 R&D expenditures: FY 2004–11 and TABLE 16: Federally financed higher education R&D expenditures, ranked by FY 2011 R&D expenditures: FY 2004–11. Institutions within the Metro Atlanta and comparison regions reporting to NSF in 2012 are as follows:

Atlanta	Boston	San Diego
Agnes Scott College	Babson College	CA State University, San Marcos
Clark Atlanta University	Boston College	National University
Emory University	Boston University	Naval Postgraduate School
GA Institute of Technology	Brandeis University	San Diego State University
GA State University	Bridgewater State College	Scripps Research Institute
Kennesaw State University	Franklin W. Olin College of Engineering	University of CA, San Diego
Kent State University	Harvard University	University of San Diego
Morehouse College	MA Institute of Technology	
Morehouse School of Medicine	MGH Institute of Health Professions	
Southern Polytechnic State University	New England College of Optometry	
Spelman College	New England School of Acupuncture	
University of GA	Northeastern University	
University of West GA	Simmons College	
	Suffolk University	
	Tufts University	
	University of MA, Boston	
	University of MA, Lowell	
	University of NH	
	Wellesley College	

Austin	Denver and Boulder	Research Triangle
Southwestern University	CO School of Mines	Duke University
St. Edward's University	Regis University	NC Central University
TX A&M Health Science Ctr.	University of CO, Boulder	NC State University
TX State University, San Marcos	University of CO, Denver and Anschutz Medical Campus	Shaw University
U. TX, Austin	University of Denver	University of NC, Chapel Hill
	University of Northern CO	

Patents

Patent data provided by the U.S. Patent and Trademark Office, and consists of only Utility patents. Geographic designation is given by the location of the first inventor named on the patent application. Patents include only those patents filed by residents of each region. Regions are defined by the cities, towns, Census Designated Places (CDPs), and communities located within, the Atlanta-Sandy Springs-Marietta, GA Metro Area, the Boston-Cambridge-Quincy, MA-NH Metro Area, the Austin-Round Rock-San Marcos, TX Metro Area, Denver and Boulder (Denver-Aurora-Boulder, CO Combined Statistical Area which includes the Greeley Metro Area), Research Triangle (Durham-Chapel Hill, NC Metro Area, Raleigh-Cary, NC Metro Area), and the San Diego-Carlsbad-San Marcos, CA Metro Area. Technology Areas are based on the Unites States Patent Classification System (USPCS) and grouped according to certain technologies and/or classes and simplified by Collaborative Economics in the following way.

U.S. PTO Classification	Simplified Classification
Telecommunications & Electrical Devices	Telecommunications
Computing and Data Management (storage, security & processing)	Technology
Bioscience & Health	Bioscience & Health
Manufacturing (Vehicles, Machinery, Chemicals)*	Advanced Manufacturing
Supply Chain Logistics (Process, Dispensing, Packaging, Navigation)	Supply Chain Logistics
Optical Measuring & Testing, Waveguides, Optics	Combined as "Other"
Other	

Academic licenses, startups spinning out of universities, and productivity of research

Data are extracted from the Statistics Access for Tech Transfer (STATT) database collected by the Association of University Technology Managers (AUTM) survey from participating academic institutions. Data is reported in fiscal years and is inflation adjusted. Productivity of Research is calculated by dividing number of licenses executed by the region and dividing it by AUTM reported research expenditures, for internal consistency. Institutions reporting to AUTM in 2012 are as follows:

Boston	Atlanta
Beth Israel Deaconess Medical Center	Emory University
Boston College	Georgia Institute of Technology
Boston University/Boston Medical Center	Institute of Paper Science and Tech.
Brandeis University	Kent State University
Brigham & Women's Hospital	University of Georgia
CBR Institute for Biomedical Research	
Children's Hospital Boston	**Denver and Boulder**
Dana-Farber Cancer Institute	Colorado School of Mines
Harvard University	National Jewish Center
Massachusetts General Hospital	University of Colorado
Massachusetts Institute of Technology (MIT)	University of Denver
New England Deaconess Hospital	
New England Medical Center	**Research Triangle**
Northeastern University	Duke University
Schepens Eye Research Institute	North Carolina State University
St. Elizabeth's Medical Center of Boston	University of North Carolina Chapel Hill
The Forsyth Institute	
Tufts University	
University of Massachusetts	
University of New Hampshire	
Whitehead Institute for Biomedical Research	

SBIR/STTR

U.S. Small Business Administration, Office of Technology Small Business Innovation Research Program (SBIR/STTR). Small businesses must be American-owned and independently operated, for-profit, principal researcher employed by business, and company size limited to 500 employees to participate in the program.

Angel funding, Series A, VC, total investment, M&As, IPOs

Investment data - Angel, VC, Mergers, Acquisitions, Debt, and Grants and other forms of investment - are provided by CB Insights (www.cbinsights.com) and includes disclosed investment deals in more than 80,000 private companies. Venture capital data includes seed, series A-E+, growth equity, bridge, and incubator series types. Debt includes loan guarantees from the federal government, as well as credit and loans from private investors such as banks, investment funds, and financial services groups. Grants include grants from federal and state government agencies. Other investment types included in Total Investment include PIPE, private equity, convertible notes, minority interest by corporation, unattributed, other, and partnership. Company exit data is also provided by CB Insights by investment stages M&A and IPO. All deal data adjusted to 2013 dollars using the Consumer Price Index.

Startup Acquisitions

Acquisition data comes from CrunchBase (www.crunchbase.com) a crowdsourced dataset of startup activity. Crunchbase has more than 500k profiles of people and companies that are maintained by tens of thousands of contributors. Acquisition data is not considered to be a census but a survey of acquisitions.

Innovation Industry Employment and Wages

The Quarterly Workforce Indicators (QWI) provide local labor market statistics by industry, worker demographics, employer age and size. The QWI source data are unique job-level data that link workers to their employers. The source data for the QWI is the Longitudinal Employer-Household Dynamics (LEHD) linked employer employee microdata. The LEHD data is massive longitudinal database covering over 95% of U.S. private sector jobs. Much of this data is collected via a unique federal-state data sharing collaboration, the Local Employment Dynamics (LED) partnership. LED is a cooperative venture between the LEHD program at the U.S. Census Bureau and state agencies of all 50 states, the District of Columbia, Puerto Rico, and the U.S. Virgin Islands. Data for Massachusetts, Puerto Rico, and the US Virgin Islands are under development. A wide variety of record sources contribute to the construction of the QWI, including the administrative records on employment collected by the states, Social Security data, Federal tax records, and other census and survey data. Industry data is available at the 4-digit NAICS level.

Innovation Industries are based on the BLS definition of high-tech NAICS industries, but include additional scientific industries. Innovation Industries at the 4-digit NAICS level include:

4 Digit NAICS	Innovation Industries
3254	Pharmaceutical and Medicine Manufacturing
3272	Glass and Glass Product Manufacturing
3341	Computer and Peripheral Equipment Manufacturing
3342	Communications Equipment Manufacturing
3344	Semiconductor and Other Electronic Component Manufacturing
3345	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing
3346	Manufacturing and Reproducing Magnetic and Optical Media
3351	Electric Lighting Equipment Manufacturing
3353	Electrical Equipment Manufacturing
3359	Other Electrical Equipment and Component Manufacturing
3364	Aerospace Product and Parts Manufacturing
3391	Medical Equipment and Supplies Manufacturing
4234	Professional and Commercial Equipment and Supplies Merchant Wholesalers
4236	Household Appliances and Electrical and Electronic Goods Merchant Wholesalers
5112	Software Publishers
5122	Sound Recording Industries
5151	Radio and Television Broadcasting
5182	Data Processing, Hosting, and Related Services
5191	Other Information Services
5415	Computer Systems Design and Related Services
5416	Management, Scientific, and Technical Consulting Services
5417	Scientific Research and Development Services
5419	Other Professional, Scientific, and Technical Services
6215	Medical and Diagnostic Laboratories
8112	Electronic and Precision Equipment Repair and Maintenance