

# Innovation & Entrepreneurial Index

Is **our** glass half empty or *half full*?

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## What is the Innovation & Entrepreneurial Index?

The purpose of the Innovation & Entrepreneurial Index is to look at the Innovation Economy in the Philadelphia Primary Metropolitan Statistical Area (PMSA) and assess how well the region is doing relative to the nation and a select group of benchmarks. While **our** recommendations are for the Philadelphia region, our analysis is relevant to Pittsburgh, other regions and the entire Commonwealth. It is up to each region as well as the Commonwealth to develop its own strategies and recommendations.

The Innovation Economy — that portion of economic activity driven by creation processes in the sciences — is becoming more important as regions compete for stature in the overall global economy. The Innovation Economy is about creativity — technology-based research, development and commercialization in the life and physical sciences. The Innovation Economy has already begun to usher in a new period of economic growth, with new opportunities — new companies, new jobs, higher wages and more rapid wage growth. By recent estimates, innovation accounts for more than half of the economic growth in the United States (*The Economist*; September 19, 2002). Those regions with the right mix of resources to encourage such growth will reap the benefits and succeed in the race to compete globally.

In all cases, the key is competition. Job creation and business formation are often zero-sum games — “either...or.” Either you win or you lose. Either the jobs and companies start here or they don't. Either they stay and grow here, or they leave. Regions compete for resources, human capital — talent — and dollars, to generate ideas that grow to fruition as commercially successful ventures — that is, new companies, new products, new processes. The sum of all of these parts is the Innovation Economy.

The Innovation & Entrepreneurial Index compares the fourth largest metropolitan region in the United States, Philadelphia (based on population data), to seven other regions through a series of key metrics in three categories — Knowledge, Capital and Location — that nurture innovative businesses throughout their life cycles. The metropolitan areas selected for comparison (including population) are:

- Philadelphia (**PHL**), 5.1 million;
- Pittsburgh (**PIT**), 2.4 million;
- Baltimore (**BAL**), 2.6 million;
- Washington, D.C./Northern VA (**WAS**), 4.9 million;
- New York City (**NYC**), 9.3 million;
- Boston (**BOS**), 3.4 million;
- Research Triangle Park (**RDU**), (Raleigh-Durham-Chapel Hill), 1.2 million;
- San Diego (**SAN**), 2.8 million.

The benchmark regions are, with one exception, East Coast regions with which Philadelphia competes in its efforts to attract, retain and grow new businesses and knowledge workers. San Diego shows up in the comparison list because it is a region with an emerging life sciences sector, a technology cluster that is also important to Philadelphia. This report does not look at areas that have already been “studied to death”, such as Silicon Valley, in California, and Austin, Texas.

This Index is distinguishable from other regional measurement efforts because it focuses on the inputs that support the creation, retention and recruitment of innovative businesses in their early stages of development. A total of 29 scorecard-specific indicators were researched and analyzed. Also included is new research by Dr. Richard Florida, Dr. Michael Porter and The Brookings Institution.

Innovation fuels economic growth. In order for a region to stimulate growth, it must reinforce its strengths and address its weaknesses through a collaborative development strategy. The Philadelphia region's potential for growth is unlimited. We have the resources to attract, retain and expand firms and the skilled labor pool, but we must decide how to respond — whether to fill the glass to the brim or leave it half empty. The Innovation & Entrepreneurial Index is a guide that helps to evaluate what actions we must take to fill the glass and make sure that it remains full.



**Richard A. Bendis**

CEO & President  
Innovation Philadelphia



### The Philadelphia Innovation Economy

The Innovation Economy includes technology-based industrial sectors that contain young, new companies, as well as some of the fastest-growing companies — indeed, many upstarts are both young and fast growing. The Innovation Economy also includes the research and education infrastructure — dollars and talent — that are necessary ingredients for the creative process. In the right combination and the correct proportions, such ingredients create a vibrant and dynamic blend of new economic activity — new companies, new jobs, higher wages, and faster wage growth.

Philadelphia has a rich mix of raw materials that are vital in order to compete globally in the Innovation Economy. They cannot be thrown together in an arbitrary fashion with the expectation that economic success is a given outcome, any more than one can take raw ingredients like butter, flour, milk and eggs and toss those into a pan haphazardly with the expectation that a great soufflé will occur. Order, direction and supervision are also prerequisites — in other words, “leadership”. So, too, is good luck.

This report does more than assess the state of raw materials — inputs and outcomes — relating to the Philadelphia Innovation Economy. It makes recommendations relating to each indicator, and it includes a set of next steps or action items that will enhance Philadelphia’s ability to compete.

#### *Where does the Philadelphia region stand?*

The major finding of this report is that Philadelphia has a realistic opportunity to compete globally in the Innovation Economy, but more must be done to create competitive advantages for economic success in high-growth, high-wage industries. Philadelphia has many of the necessary ingredients, but often the right proportion is lacking. More must be done to leverage existing resources and to support and enhance existing technology clusters. Philadelphia is in the race, but victory is not yet certain. The region’s entrepreneurial image and climate must be improved.

Philadelphia has a sufficient number of technology-based industries but they require nourishment. More investment must be forthcoming from the local business and academic community, as well as the public sector, and more collaborative initiatives need to be undertaken to attract more outside capital to the region and to leverage existing resources — technical, capital and human. More of the region’s universities must step to the plate and make better use of faculty, staff and students in order to gain a competitive advantage.

A good example of what can be done shows up in North Carolina, in the Raleigh-Durham area. Through a mix of cooperation, use of federal research investment programs and the active participation of state and local government, the region has expanded industrial and academic research investment within the academic community — a notable achievement.

#### *What is needed?*

In order to compete globally, Philadelphia’s Innovation Economy must include a set of technology-based industries that have critical mass. It is as difficult to attract new industries to a region as it is to grow a new industrial base from scratch. Existing industries, however, provide ready-made infrastructure that includes skilled workers, research facilities, expertise and a network of identified sources of capital and suppliers (for raw and intermediate materials) – in other words, complete industrial clusters. Thus, a diverse set of industrial clusters with a record of success locally, provides a good starting point for building and enhancing global competitiveness in the Innovation Economy.

Another necessary ingredient for global competitiveness is strong research infrastructure that is capable of generating new ideas and nurturing them through the earliest stages of development. Philadelphia possesses corporate headquarters, research facilities and academic research facilities that generate large numbers of patents. The region does not, however, possess a major national or federal research facility. All of the region’s resources — public, private and academic — should be utilized to obtain more federal research money, preferably through the attraction of such a permanent nationally recognized federal research laboratory.

Corporate direction can change as a result of global market conditions. Philadelphia’s academic community has to leverage the investment that it receives — and must do its best to receive more — by engaging the corporate community in collaborative initiatives to generate and spin out ideas and patents that lead to commercial success. In turn, the corporate community must become a more willing and involved partner. To date, local collaborative entrepreneurial activity has not achieved all that it can. Several federal award programs exist to assist in early-stage feasibility and commercialization work. Local researchers have not used them to the full extent.

Venture capital is another ingredient necessary for encouraging entrepreneurs and nurturing ideas through to commercialization. Venture capital investments help keep the innovation pipeline flowing. Investment dollars have to be available for many technology sectors, not just a few, and investments must come at all stages and in all sizes. Philadelphia continues to face a “capital gap” for early investments in the \$500,000 to \$1.5 million range.

Philadelphia has a good mix of skilled technical workers in life sciences and information technology, but the supply has to be continually replenished and workers must be encouraged to remain when larger, more mature employers restructure. The region needs to expand its efforts to change the “brain drain” to “brain gain” and to create a world-class lifelong learning environment for knowledge workers and entrepreneurs. Where possible, some of the risks associated with start-up activity need to be offset by creating the right

climate for entrepreneurial risk-taking. Success spawns more success. Again, a healthy venture capital environment provides more likelihood of later stage commercial success. When companies succeed by going public, entrepreneurs and venture capitalists are able to reinvest the proceeds of initial public offerings in a virtuous circle of wealth creation.

A common thread that runs through all of the findings and recommendations in this report is the need for parties that help the State and region grow to work together. There must be greater coordination and collaboration among industry, government, academic and non-profit organizations involved in key economic development initiatives — to leverage efforts and investment and increase output and impact. To remain vibrant and globally competitive, the Innovation Economy makes no room for those who would choose silos or the status quo over participation, cooperation and dynamic engagement. In the words of one of Philadelphia's and Pennsylvania's greatest innovators and entrepreneurs, Benjamin Franklin: "We must indeed all hang together, or, most assuredly, we shall all hang separately."

*“The region must aggressively leverage academic, state, local, industry & federal resources to maximize our competitive advantage in the Knowledge Economy.”*

**Dr. Judith Rodin**  
President

University of Pennsylvania

## Our Recommendations

**The State and region become more aggressive in soliciting federal research awards, including one or more federal research centers of national significance**  
and investment in strategic technologies that will strengthen the economy. There must be more collaboration between academia, industry, state and local government to provide greater leverage against all federal research investment in the region. Finally, all of the academic institutions with R&D missions must actively and fully become involved in the process.

**The State and region must aggressively pursue the commercialization of technologies developed at local universities,**  
in order to spin out new companies and retain knowledge workers.

### Knowledge

**The State and region must become more aggressive at applying for and winning competitive federal small business research investment awards.**

**The State and region must increase the total pool of risk capital available locally,**  
especially angel, pre-seed, seed and early stage funds. It is important that adequate funds be available to capitalize emerging technology businesses throughout their life cycles. Tax credits and other tax policy are important tools for increasing the available pool of risk capital. Industry, academia and government must all participate to create effective tax legislation.

**Effective business assistance programs must be made available**  
to local start-ups to increase their prospects for commercial success and raise the amount of outside capital they are can attract.

### Capital

**Philadelphia must capitalize upon the great competitive advantage of its location**  
as a global gateway, and strengthen relationships in Harrisburg, New York City, and Washington, D.C.

**The State and region must strengthen the connections between local industry and academia,**  
to address future work force needs, create world-class lifelong learning opportunities and improve collaborations that lead to the commercialization of academic applied research.

**The State and region create a vibrant environment for new business start-ups,**  
for retaining and growing existing businesses and for recruiting firms in strategic technology clusters.

**The State and region must enhance the image of the Commonwealth and Philadelphia**  
as global leaders in the Innovation Economy, at home and globally, and must aggressively promote Pennsylvania and Philadelphia as quality places to live and conduct business.

### Location

## Innovation Philadelphia's Action Items



### INCREASE RESEARCH INVESTMENT

#### Research Dollars Program

A unique online program that offers technical and financial assistance to the region's researchers and early stage technology companies to assist them in winning more federal grant dollars for developing and commercializing new technology.

### ACCELERATE COMMERCIALIZATION SUPPORT

#### Mid Atlantic Commercialization Corporation

Through this organization, Innovation Philadelphia is working with regional technology transfer offices to accelerate the rate of commercialization by increasing the number of university spin out companies

### INCREASE RESEARCH INVESTMENT

#### 2002 Federal and State Technology (FAST)

Innovation Philadelphia is participating in the Innovation Partnership with the PA Small Business Development Centers, Catalyst Connection, Ben Franklin Technology Partners and the PA Department of Community Economic Development. The partnership will increase SBIR/STTR awards in Pennsylvania; encourage greater program participation across the Commonwealth; increase the proposal win rate across the State; and increase technology commercialization.

### INCREASE PRE-SEED & SEED CAPITAL

#### Economic Stimulus Fund and Mid Atlantic Angel Group

Innovation Philadelphia has established the Economic Stimulus Fund (ESF) and the Mid Atlantic Angel Group (MAG) to address the pre-seed and seed capital funding gap of \$500,000 to \$1,500,000.

### INCREASE ENTREPRENEURIAL RESOURCES

Innovation Philadelphia provides valuable regional resources through the following publications:

- Entrepreneurs' Resource Guide*
- Innovation & Entrepreneurial Index*
- Greater Philadelphia Financial Resource Guide* (January 2003)
- Strategic Cluster Analysis* (Spring 2003)

### INCREASE BRAIN GAIN

#### The Knowledge Industry Partnership,

a consortium of universities, community colleges, civic groups and government entities, supporting regional student attraction, engagement and retention programs.

### ENHANCE GLOBAL IMAGE

Innovation Philadelphia is aggressively marketing the region through new partnerships and relationships with international organizations including the United Nations, NATO and selected international partners.

*"I am committed to continuing our partnership to make Pennsylvania a national leader and a world competitor. Together, we will showcase Philadelphia and Pennsylvania's exciting job opportunities, world-class companies and top-notch quality of life. Together, we will provide the resources and environment of opportunity necessary for Pennsylvania's entrepreneurs to succeed and grow. Together, we will 'Invent the Future in Pennsylvania'."*

**Mark Schweiker**  
Governor, Commonwealth of Pennsylvania

LOCAL INNOVATION...GLOBAL REALIZATION

### How to Use this Index

The Innovation Economy has already begun to usher in an extraordinary period of economic growth, with new opportunities — new companies, more jobs and higher wages. Those regions with the right mix of resources to encourage further growth will reap the benefits and succeed in the race to compete globally.

The Innovation Economy is about creativity — technology-based research, development and commercialization in the life and physical sciences. This section of the publication focuses on factors of production, or inputs, as well as outcomes measures, relating to the Innovation Economy. The index is divided into three parts: **Knowledge Indicators**, **Capital Indicators** and **Location Indicators**. Each part contains descriptions of individual indicators — inputs and outcomes — and some measurement which compares the Philadelphia region's performance to the seven benchmark, or comparison, regions and, where possible, to the nation. National comparisons are based on “average” or normalized data — for example, per capita or per student. Unlike comparisons based on total or aggregate data, normalized data allows comparisons between the region and the nation, and provides a means of comparing region to region that controls for variations in size. [Note: Values shown on charts throughout this publication are rounded.]

**Knowledge Indicators** relate to factors of production associated with universities — for example, investment in research and development, science and engineering degrees awarded — and related outcomes — for example, invention disclosures and patents, royalties, start-ups based on university technology — as well as other measures of innovation such as regional patent activity.

**Capital Indicators** are inputs that fund innovation activity — for example, Federal government awards for research and development, commercialization activity and venture capital — and related outcomes, such as initial public offerings.

**Location Indicators** include measures that provide marketing and other regional benefits, such as business location rankings, skilled technical workers and interregional travel time. Some of these indicators also provide a measure of entrepreneurial climate, such as gazelle firm employment and business starts.

#### Key Indicators Scorecard

The scores on the next page provide a report card summary of the Philadelphia region's performance as compared to the nation and the seven other benchmark regions. The scores are not empirically derived, like the indicators themselves, but represent the best effort of Innovation Philadelphia to provide comparable ratings in an easy-to-understand fashion for indicators with different values and units of measure. For each section — **Knowledge, Capital and Location** — Philadelphia was scored from 1 to 5 (1 = Major Weakness; 3 = Neutral; 5 = Major Strength) on each indicator. Philadelphia's individual

indicator scores were summed and compared to a perfect score of all fives. In some cases, based on data, comparison between Philadelphia and the nation was not possible or such comparison would be meaningless. In that event, a dash appears next to the indicator in the “National” column.

Philadelphia's performance, scoring 77 out of a total possible score of 145 against the seven benchmark regions, places it squarely in the middle of the road — which is not a desirable place to be. The region's performance indicates no leadership in any category except “Transport Time to D.C. and N.Y.C.,” where natural geography placed Philadelphia between two other regions important to the Innovation Economy — Washington, DC, the nation's seat of government and public capital, and New York City, the center of private finance. Geography plays as much role as human intervention in that case (moreover, as stated in detail in Indicator 19, Philadelphians must work to ensure that they do not lose the advantage of proximity to D.C. and N.Y.C. provided by Amtrak).

Much work needs to be started soon and completed over the next ten years to keep Philadelphia a global competitor in the Innovation Economy and to improve its rank. The choice is not between “do nothing” while holding our own or “do something” to improve. Many regions are prepared to overtake those on the cusp or that do nothing to improve their lot — including Philadelphia. The Innovation & Entrepreneurial Index is one contribution by Innovation Philadelphia to make sure that the glass, which begins half full, is filled further and remains full.

*“It is not the strongest of species that survive, nor the most intelligent, but the ones most responsive to change.”*

Charles Darwin

## Key Indicators Scorecard

*“Science is a capital or fund perpetually reinvested; it accumulates, rolls up, is carried forward by every new man.”*

John Burroughs  
American Author, Naturalist

National	Regional Benchmark		
<b>KNOWLEDGE</b>			
1	2	Indicator 1:	Federal Investment in University Science & Engineering Research
1	2	Indicator 2:	State & Local Investment in University Science & Engineering Research
1	2	Indicator 3:	Industry & Other Support in University Science & Engineering Research
1	2	Indicator 4:	Institutional Support in University Science & Engineering Research
3	4	Indicator 5:	Size of College & University Endowments
4	3	Indicator 6:	Science & Engineering Degrees Awarded
—	3	Indicator 7:	Invention Disclosures & Patents Filed by Research Institutions
—	4	Indicator 8:	Patent Productivity
—	3	Indicator 9:	Royalty and Licensing Income to Universities
—	2	Indicator 10:	Start-up Companies Formed from University Research
<b>27/50</b>		<b>Total: Knowledge Indicators</b>	
<b>CAPITAL</b>			
—	2	Indicator 11:	SBIR & STTR Awards
—	2	Indicator 12:	NIH SBIR & STTR Proposals & Awards
—	1	Indicator 13:	ATP Proposals & Awards
—	2	Indicator 14:	Early-Stage Venture Capital Investments
—	2	Indicator 15:	Medical/Health/Life Science Venture Capital Investments
—	2	Indicator 16:	Information Technology Venture Capital Investments
4	3	Indicator 17:	Publicly Traded Companies
—	2	Indicator 18:	Initial Public Offerings
<b>16/40</b>		<b>Total: Capital Indicators</b>	
<b>LOCATION</b>			
—	5	Indicator 19:	Transport Time to DC & NYC
—	4	Indicator 20:	Non-Stop Destinations Served
—	3	Indicator 21:	Broadband Internet Availability
3	3	Indicator 22:	Skilled Information Technology Workforce
3	3	Indicator 23:	Skilled Life Sciences/Biotechnology Workforce
—	4	Indicator 24:	Brookings Biotechnology Rankings
—	2	Indicator 25:	Business Location Rankings
2	2	Indicator 26:	New Business Starts
1	2	Indicator 27:	Business Migration
3	3	Indicator 28:	Gazelle Firms Employment
—	3	Indicator 29:	Creative Class Ranking
<b>34/55</b>		<b>Total: Location Indicators</b>	
<b>77/145</b>		<b>Overall Regional Rating</b>	

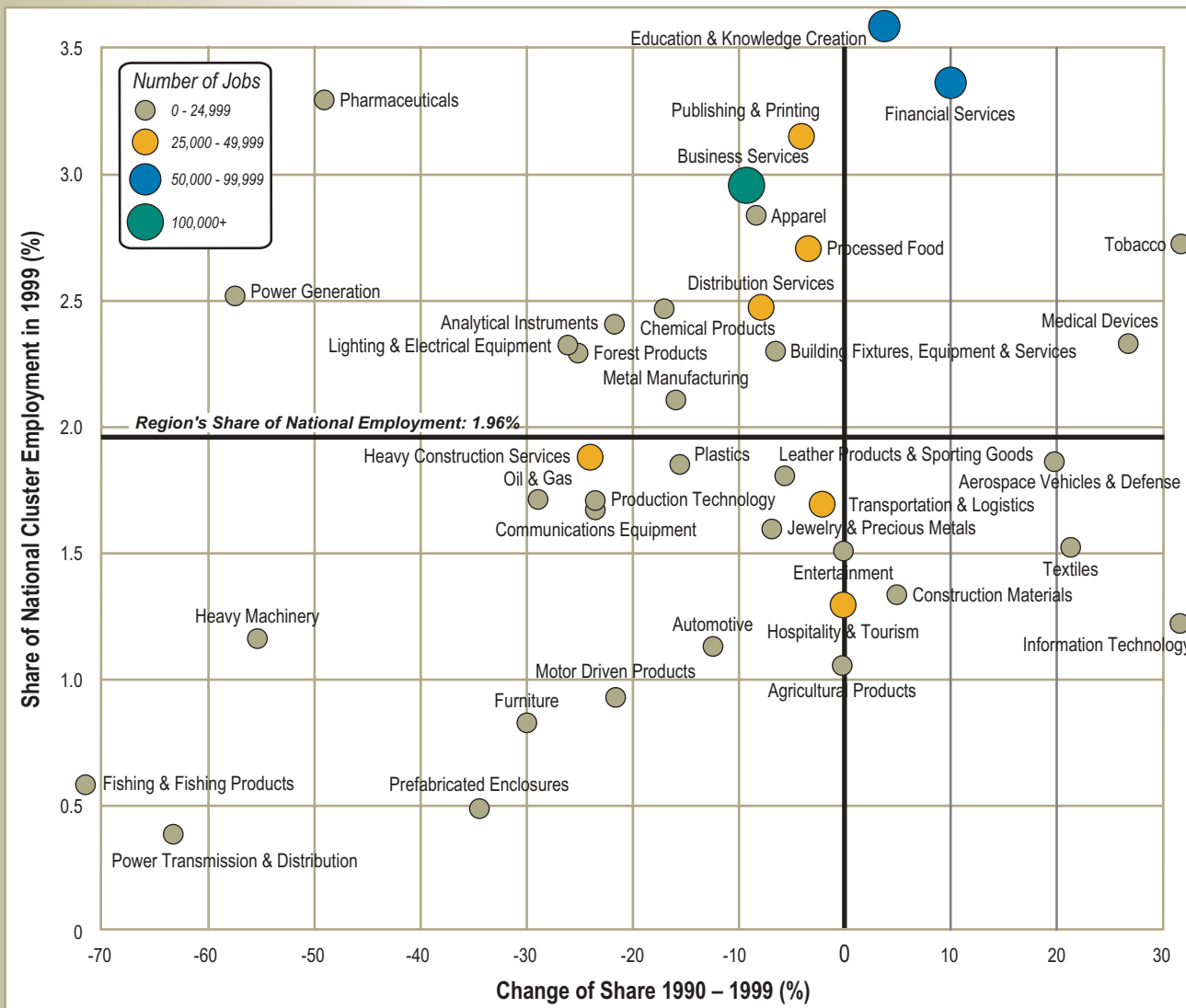
**Rating Key:**

- 5 Major Strength
- 4 Strength
- 3 Neutral
- 2 Weakness
- 1 Major Weakness

# Philadelphia Industry Clusters

## Overview

Philadelphia, PA-NJ Metropolitan Area Specialization of Traded Cluster Using Narrow Cluster Definition



Source: Cluster Mapping Project, Institute for Strategy & Competitiveness, Harvard Business School. Copyright © 2002 by the President and Fellows of Harvard College. All rights reserved.  
NOTE: Fishing & Fishing Products, Education & Knowledge Creation, Tobacco, and Information Technology values fall outside of the depicted range.

### Cluster Specialization of the Philadelphia Region

An industrial cluster is an interconnected assembly of companies and associated institutions in a specific field, with close geographic proximity within a region. Clusters arise because of the advantages that accrue to specific locations for specific industries — for example, proximity to major markets, tax or regulatory advantages — and the economic advantages of assembling related firms within geographic proximity, such as lower distribution costs or adequate workforce. An example of a specialty cluster is hospitality and tourism in the New Jersey seashore communities of Atlantic and Cape May Counties. That cluster includes casinos, hotels, restaurants and all of the associated goods and service suppliers, trade associations, training centers and so on.

This chart identifies industrial clusters of economic significance in the Philadelphia region. Clusters where the local economy has a higher share or concentration of employment than the region's overall share of U.S. employment — Philadelphia's share of total U.S. employment is 1.96 percent for the period on the chart — appear above the dark horizontal axis. Similarly, clusters where the local growth rate is greater than for the entire U.S. cluster, appear to the right of the dark vertical axis.

Another way to interpret the data on this chart is:

- Clusters in the upper right-hand quadrant are the region's strongest and most dynamic;
- Clusters in the lower right-hand quadrant are gaining employment share in the region but are not yet large or prominent;

- Clusters in the upper left-hand quadrant are strong but losing share — this quadrant typically contains clusters that are traditionally important to the region;
- Clusters in the lower left-hand quadrant are of limited competitiveness within the region.

As the chart shows, Philadelphia's economy is a mixture of traditional and innovative clusters.

To give examples in each quadrant of the chart:

- Education and Knowledge Creation, as well as Financial Services, are both local industry clusters of 50,000 to 99,999 jobs (Education and Knowledge Creation = 83,748; Financial Services = 91,369), with more than their proportional share of U.S. employment (each has between 3.25 and 3.5 percent of the U.S. total, rather than 1.96 percent), and that are growing faster than their respective national clusters;
- Information Technology is a cluster of 0 to 24,999 jobs (13,702), with less than its proportional share of U.S. employment and growing faster than the national communications equipment cluster;
- Pharmaceuticals is a cluster of 0 to 24,999 jobs (7,574), with more than its proportional share of U.S. employment and growing slower than the national pharmaceutical cluster;
- Communications Equipment is a cluster of 0 to 24,999 jobs (6,533), with less than its proportional share of U.S. employment and growing slower than the national communications equipment cluster.

## Job Creation by Clusters

This chart shows the change in cluster employment in the Philadelphia region from 1990 through 1999. During that period, the region created 114,773 jobs and lost 80,909 jobs — a net gain of 33,824 jobs.

Three of the region's larger clusters — each with greater concentration locally than across the nation — accounted for two-thirds of the total jobs created:

- Business Services (33,710 jobs created; 29.4 percent of total);
- Education and Knowledge Creation (23,222 jobs created; 20.2 percent of total);
- Financial Services (24,777 jobs created; 21.6 percent of total).

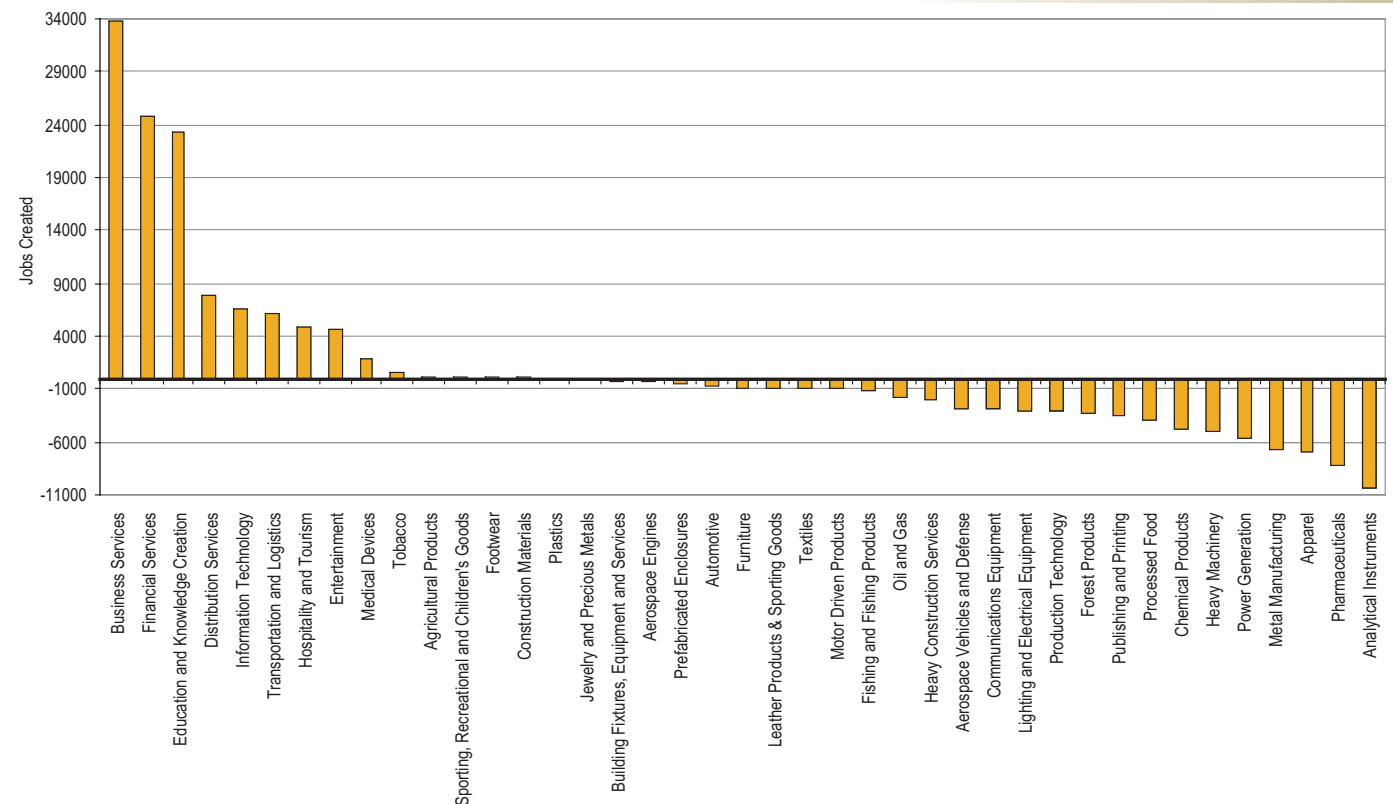
Education and Financial Services both exhibited growth rates locally that were faster than for the corresponding national clusters, as illustrated by their position in the upper-right-

hand quadrant of the Cluster Specialization chart, shown on the previous page. Together they accounted for almost half of the jobs created locally.


By comparison, two high-technology clusters that grew — Medical Devices and Information Technology — added 12 percent of the jobs gained during the period.

This view of the region confirms Philadelphia's continued reliance on traditional clusters even as those relating to the Innovation Economy become more prominent locally.

Philadelphia Job Creation by Cluster 1990-1999



Source: Cluster Mapping Project, Institute for Strategy & Competitiveness, Harvard Business School. Copyright © 2002 by the President and Fellows of Harvard College. All rights reserved.

A blue-tinted photograph of a graduation cap on a wooden stand. The stand is covered with several books and a rolled-up diploma tied with a ribbon. The background is a plain, light color.

***“The beginning of knowledge  
is the discovery of something  
we do not understand.”***

**Frank Herbert**  
Science Fiction Author

# KNOWLEDGE Overview

## Support for Academic Institutional Research and Development

Research and Development investment at universities is an essential component of economic development, as well as a factor in marketplace innovation. In addition to using their own funds, universities receive R&D support from federal, state and local governments as well as private industry. Each segment or entity invests for a variety of reasons. Ultimately, the fruits of these inputs spill over to the community and result in improvements and the commercialization of new and existing products and processes — innovations that spawn growth through new jobs, new companies and other economic measures. Metropolitan regions that attract more R&D investment spin out more commercial opportunities, and can generally achieve greater economic success, as measured by other economic parameters.

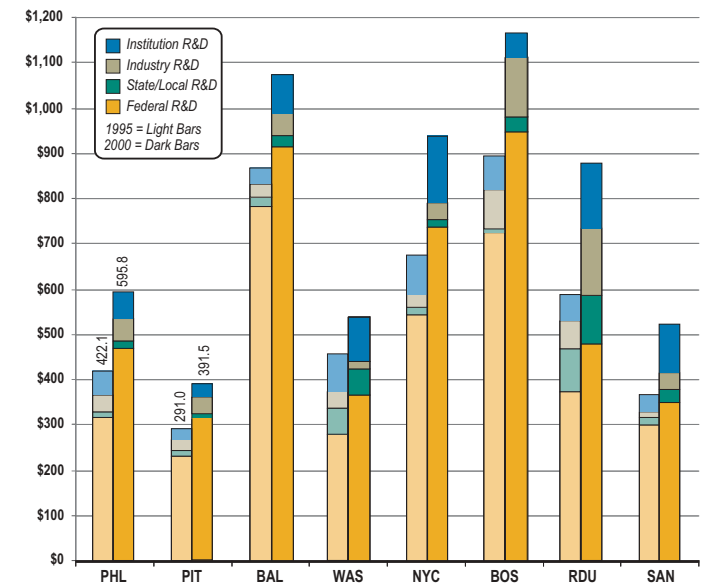
A good example of what can be done with leverage and co-investment is illustrated by Raleigh-Durham (RDU). Through a mix of cooperation, use of federal research investment programs and the active participation of state and local government, the region has dramatically expanded industrial and academic research investment within the academic community. By 2000, the combined state, local, industrial and academic institutional investment in science and engineering R&D at universities was nearly as much as federal R&D investment in the region. By comparison, in the Philadelphia region, the proportion was one-fifth of federal investment, or less than half the relative share that state, local, industrial and institutional investment comprised in Raleigh-Durham. If Philadelphia's institutions (state, local, industrial and academic) had invested at a similar rate as their peers in Raleigh-Durham in 2000, this region would have seen more than \$270 million flow into science and engineering R&D at universities from all sources other than the federal government, rather than the actual figure of \$126 million. The key is strong collaboration between academia and the private sector with strong and explicit commitment from state and local government — all leveraged against federal agency research investment.

Other measures that spillover and have the potential to become commercial and economic success stories include invention disclosures, patents, royalties and, of course, start-ups spun out of university-based R&D. The successful production of such outcomes depends primarily on R&D investments. It is fueled by the faculty and the students who assist in the research during their academic careers and who are ultimately transformed into the pool of talent available for commercial applications where they may generate additional patents and, most desirably, commercial success. Finally, it is tied together by strong and enthusiastic collaboration between academia and the private sector.

### RECOMMENDATIONS

1. The State and region must become more aggressive in soliciting federal research awards, including one or more federal research centers of national significance and investment in strategic technologies that will strengthen the economy. There must be more collaboration between academia, industry, state and local government to provide greater investment leverage against all federal research investment in the region. Finally, all of the academic institutions with R&D missions must actively and fully become involved in the process.
2. The State and region must aggressively pursue the commercialization of technologies developed at local universities, in order to spin out new companies and retain knowledge workers.

Sum of All Science & Engineering R&D Investments (\$ millions)

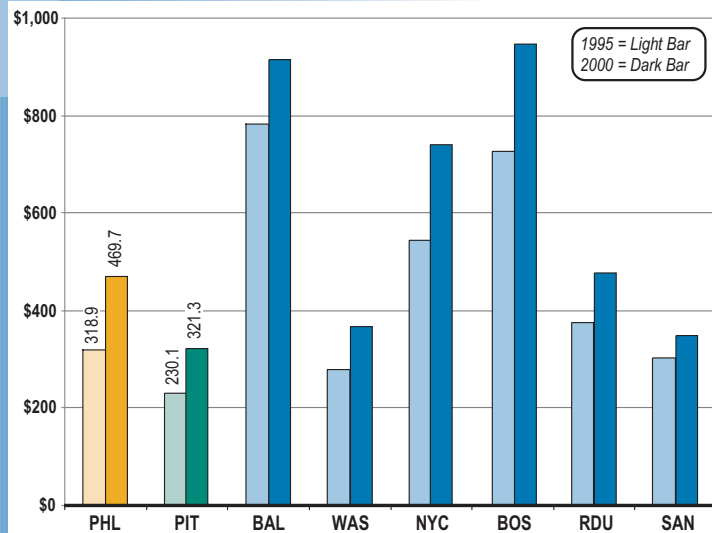


Source: National Science Foundation (NSF)

## Knowledge Indicator 1

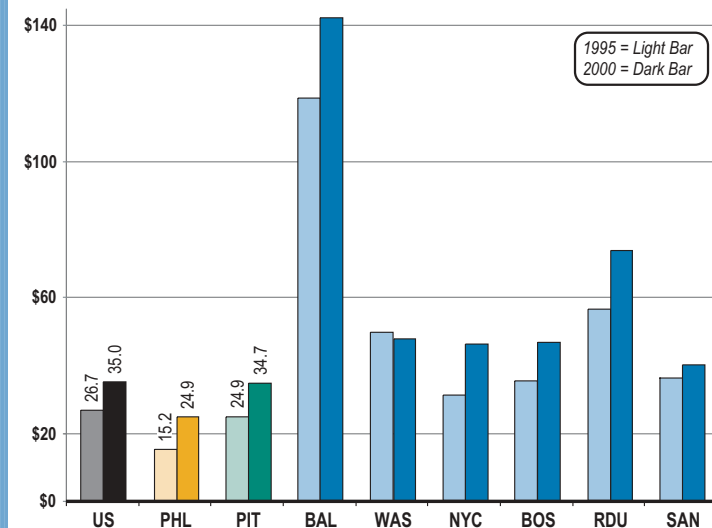
# Federal Investment in University Science & Engineering Research

Federal Expenditures for University Science & Engineering R&D (\$ millions)



Source: National Science Foundation (NSF)

Federal Expenditures for University Science & Engineering R&D per Graduate Student (\$ thousands/student)



Source: National Science Foundation (NSF)

### What is this indicator?

The federal government is the largest source of university science and engineering (S&E) R&D funding, so it acts as a key driver of academic research excellence within regions.

This indicator shows direct and reimbursed funding for science and engineering R&D from sources originating with all federal government agencies to colleges and universities in each metropolitan area from 1995 to 2000. Data are presented in aggregate form (total expenditure) and on a per student (S&E students) basis.

### Where does the Philadelphia region stand?

Federal science and engineering expenditures for university R&D rose for all eight metropolitan areas from 1995 to 2000. The Philadelphia region ranked fifth in aggregate spending in 1995 and again, in 2000. Per S&E student, the Philadelphia region ranked eighth in federal R&D expenditures to universities at the beginning and end of the period, below the national average. On both measures (aggregate and per S&E student), Philadelphia is behind several of the comparison regions. Locally, the University of Pennsylvania accounts for 69 percent of federal investment in science and engineering R&D, followed by Thomas Jefferson University, with 14 percent. The remaining institutions account for just over 15 percent of federal investment in science and engineering R&D locally.

A shortage of federal R&D dollars locally, as compared to other regions, may hamper commercial spillover, thereby restricting – or not contributing as much to – economic development.

## RECOMMENDATIONS

An aggressive and sustained effort should be launched to increase the amount of federal R&D investment in the State's and region's universities. It must be a collaborative effort with active participation by the private sector, all of the region's academic institutions and strong support from state and local government. Philadelphia's poor standing relative to the national average for this indicator also reflects the lack of a nationally recognized federal research facility in the region. That should be addressed by similar collaborative efforts.

**What is this indicator?**

In recent years, state and local government has become more engaged in using and leveraging university science and engineering R&D funds for economic development. That is indicative of state and local commitment to basic research and commercialization efforts. Often, that commitment is geared toward particular sectors or industries in which a region has or desires to obtain a competitive advantage, such as nanotechnology or biotechnology.

This indicator shows investment for science and engineering R&D from funds originating from all state, county, municipal and other local government agencies, to colleges and universities in each metropolitan area from 1995 to 2000. Data are presented in aggregate form (total expenditure) and on a per student (S&E students) basis.

**Where does the Philadelphia region stand?**

State and local science and engineering investment for university R&D varies widely by region and fluctuates from year to year. Overall, most regions, including Philadelphia, experienced an increase in state and local funding from 1995 to 2000. At the beginning and end of the period, Philadelphia ranked seventh in aggregate investment and per S&E student. The level was below the national average for per student expenditures. For both aggregate and per S&E student investment, Philadelphia falls well below the leading regions.

A shortage of state and local government R&D dollars within the region will hinder competitiveness and hamper economic growth. More states and more regions are

using this type of investment as a catalyst for economic growth. Pennsylvania runs the risk of falling behind if state and local government does not lead by example and make a strong commitment to work with the academic sector and private industry.

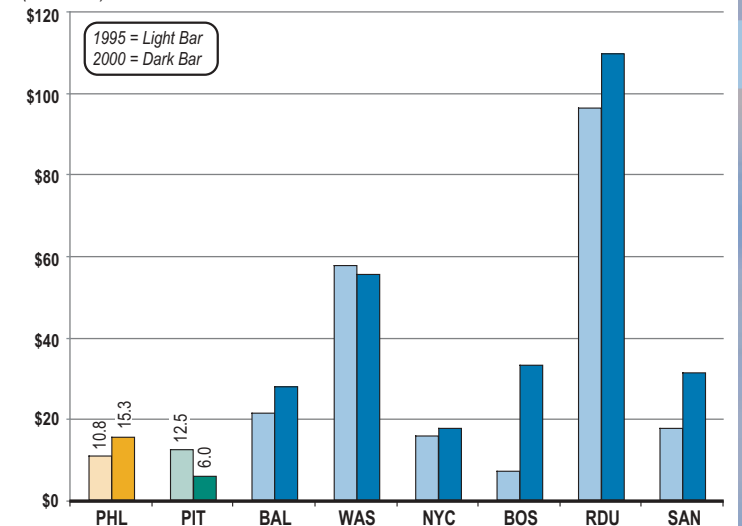
It should be noted that Pennsylvania's commitment of \$33.8 million for the Life Sciences Greenhouse initiative in Southeastern Pennsylvania — out of a total \$100 million, which is also being split with Pittsburgh and central Pennsylvania — is too recent to show up in the data that is charted. Furthermore, the funds are a one-time investment, rather than recurring, and not aimed directly — nor exclusively — at university science and engineering R&D. In addition, other states have chosen more aggressive R&D investment strategies for their tobacco settlement monies and other funds committed to science and engineering research.

**RECOMMENDATIONS**

Pennsylvania is a large state with a diverse constituency, but the jobs that will assure global competitiveness in the future are based on knowledge creation and innovation. The two regions of the Commonwealth with the greatest mix of assets that foster innovation and drive the economy are Philadelphia and Pittsburgh. State and local government investment in university science and engineering research has to substantially increase in those regions to make a major statement globally and to demonstrate the Commonwealth's commitment of regional government to federal agencies and the private sector.

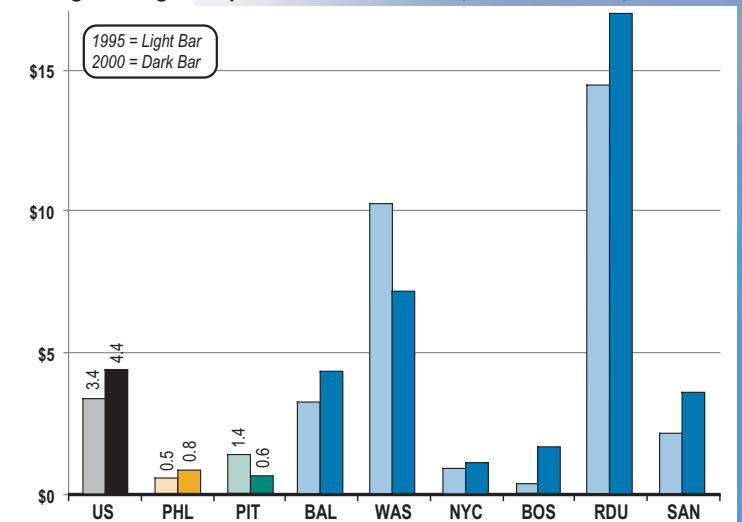
**State & Local Investment in University Science & Engineering Research**

**State & Local Expenditure for University Science & Engineering R&D** (\$ millions)



Source: National Science Foundation (NSF)

**State & Local Expenditures for University Science & Engineering R&D per Graduate Student** (\$ thousands/student)

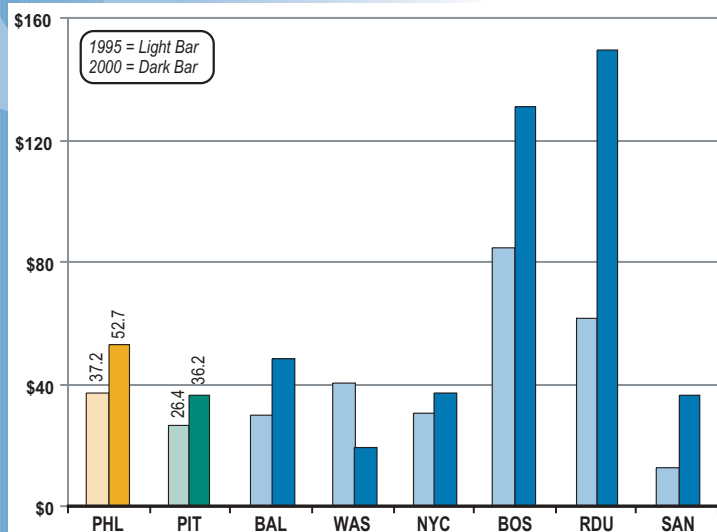


Source: National Science Foundation (NSF)

## Knowledge Indicator 3

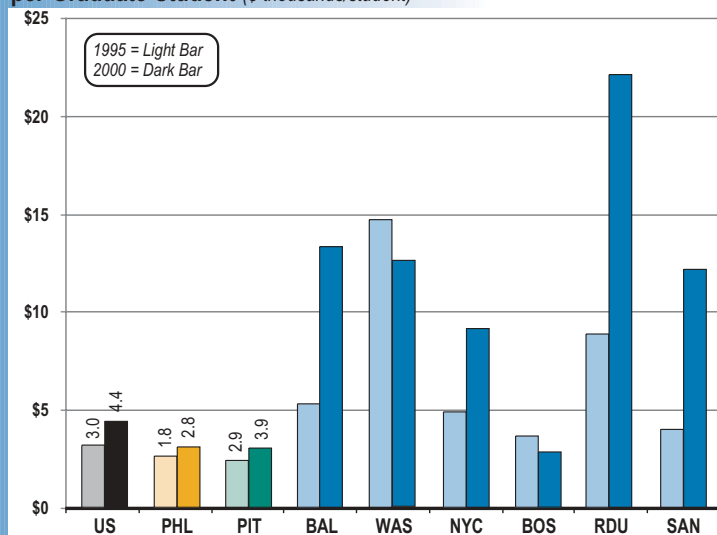
### Industry & Other Support in University Science & Engineering Research

Industry Expenditures for University Science & Engineering R&D (\$ millions)



Source: National Science Foundation (NSF)

Industry Expenditures for University Science & Engineering R&D per Graduate Student (\$ thousands/student)



Source: National Science Foundation (NSF)

#### What is this indicator?

Industry funding for university science and engineering R&D reflects the degree of interaction between a region's academic community and the business world and serves as an indication of industry's assessment of university R&D quality. Perhaps more directly than any other source of university R&D funding, industry investment in university research spills over into commercial success and translates to economic growth, however not all to the local region.

This indicator shows investments for university science and engineering R&D from profit-making organizations to colleges and universities in each metropolitan area from 1995 to 2000. Data are presented in aggregate form (total expenditure) and on a per student (S&E students) basis.

#### Where does the Philadelphia region stand?

Industry and other investment for university R&D increased for most regions, including Philadelphia, from 1995 to 2000. At the beginning of the period, Philadelphia ranked fourth in aggregate investment. The region moved up one place by 2000. Per S&E student, Philadelphia ranked sixth in both periods. That is below the national average. Philadelphia falls below the leading regions for both aggregate and per S&E student investment.

The relatively low aggregate and per student investment by industry in university science and engineering R&D in the Philadelphia region may present additional

opportunities for collaboration if it is due to incomplete knowledge by the business sector and not to negative perceptions of local institutional research. Even if pessimism does account for the explanation, perceptions can be overcome provided that is not the reality.

A good example of strong commitment by industry as well as state and local government working together with academia to leverage federal investment in university R&D, shows up in Raleigh-Durham. From 1995 to 2000, industry investment in university R&D grew 144 percent. The benefits of such committed partnerships will be apparent in Raleigh-Durham for many years to come.

#### RECOMMENDATIONS

More collaboration between industries based in the State and region and local universities will spin out more commercial success stories regionally. Universities need to attract industrial partners while the private sector needs to focus its attention and collaborate more closely with universities to help realize the potential for commercially driven applied academic R&D.

**What is this indicator?**

In addition to investment from outside sources and partners, universities also invest a portion of their own funds supporting in-house science and engineering R&D. Investing in one's self is important both for the results it can produce and the message it sends within an organization and to the surrounding community.

This indicator shows the amount that universities and colleges invest from their own funds to support internal science and engineering R&D. Data is presented in aggregate form (total expenditure) and on a per student (S&E students) basis.

**Where does the Philadelphia region stand?**

Self-funding for university R&D varies by region and fluctuated from 1995 to 2000. Most of the largest regions saw a significant increase over the period. That was not the case in Philadelphia. At the beginning of the period, Philadelphia ranked fifth in aggregate investment, moving down one place by 2000. Per S&E student, Philadelphia ranked seventh at the beginning of the period and sixth in 2000. That is far below the national average. In both aggregate terms and per S&E student, Philadelphia falls below the benchmark regions.

The relatively low aggregate and per student level of self-funded investment in university science and engineering R&D in the Philadelphia region may reflect internal perceptions regarding the adequacy of other funding sources, but it is an issue. Investors, including universities, tend to put their funds where they expect to receive the highest return. Low levels of self-funding, in aggregate and on an average basis, may cause other partners in the investment

process to question the opportunities that they perceive.

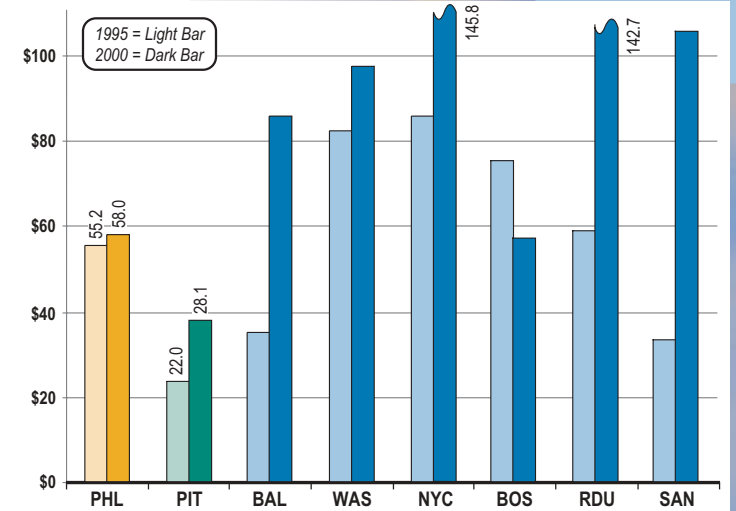
A good example of how self-investment can leverage other investment can be seen in Raleigh-Durham, where academic investment in university-based science and engineering R&D increased 142 percent from 1995 to 2000. At the same time, industry investment in academic R&D increased 144 percent. In 2000, the combined investment of state and local government, academia and industry in university science and engineering R&D was 45 percent of the total — \$272 million leveraged against \$477 million of federal investment. By comparison, state and local government, academic and industry investment in Philadelphia was just 21 percent of the total in 2000.

**RECOMMENDATIONS**

Academic self-funding for university science and engineering R&D needs to increase. It is not only a question of regional competitiveness but also one of institutional competitiveness. It is important to attract and retain world-class faculty and students. Institutional investment is a necessary ingredient to attract and leverage other "outside" sources of capital. Furthermore, the returns generated from applied research that results in commercial success can be reinvested to sustain and grow research and commercialization activity in a kind of virtuous circle. Universities also need the collaborative support of the business community to achieve such commercial success.

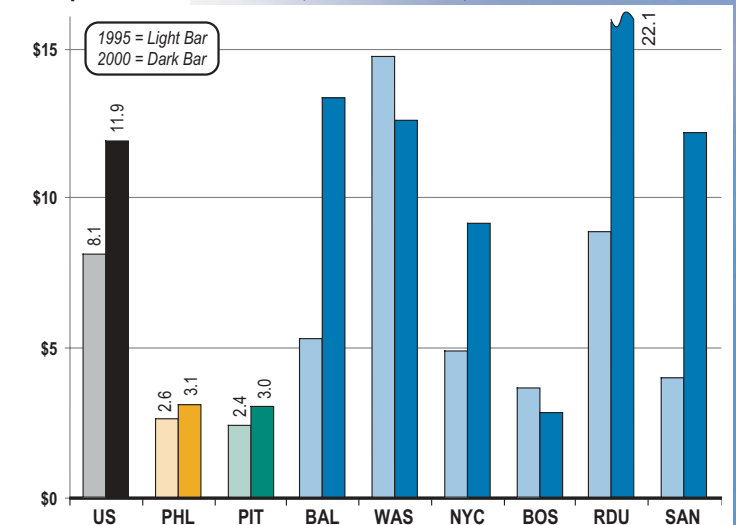
**Institutional Support in University Science & Engineering Research**

Academic Institutional Expenditures for Science & Engineering R&D (\$ millions)



Source: National Science Foundation (NSF)

**Academic Institutional Expenditures for Science & Engineering R&D per Graduate Student (\$ thousands/student)**

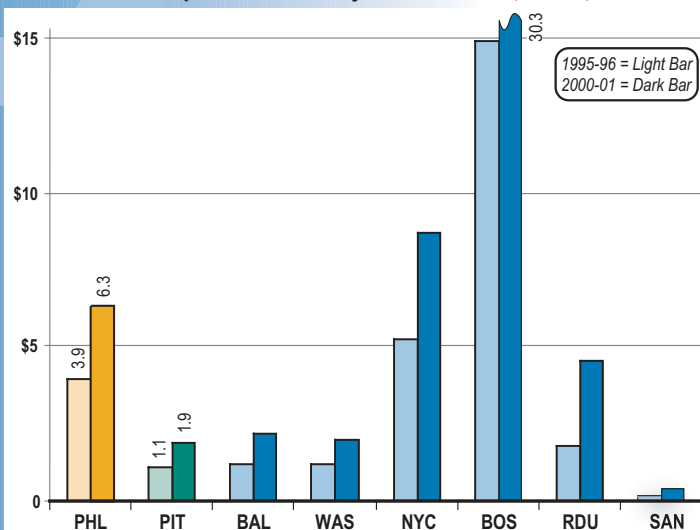


Source: National Science Foundation (NSF)

## Knowledge Indicator 5

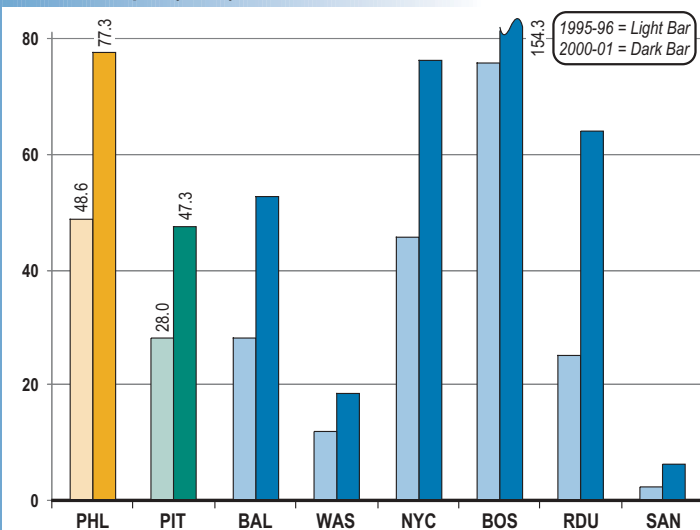
### Size of College & University Endowments

Total Value of Reported University Endowments (\$ billions)



Source: National Association of College & University Business Officers  
Enrollment: U.S. Department of Education

Endowment per (1997) Student (\$ thousands/student)



Source: National Association of College & University Business Officers  
Enrollment: U.S. Department of Education

#### What is this indicator?

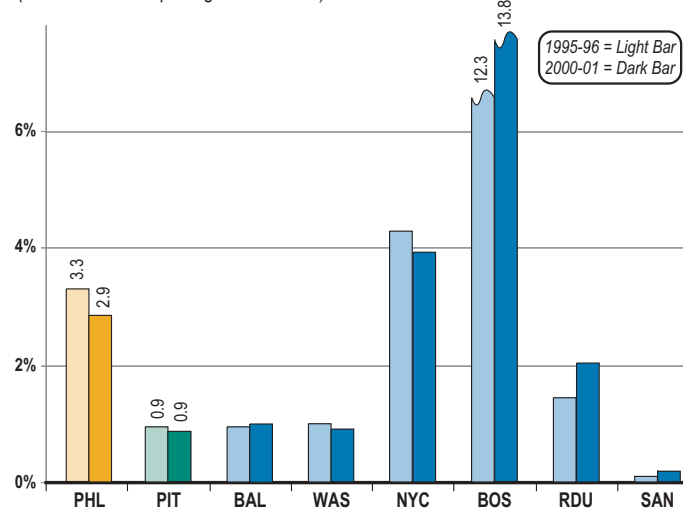
College and university endowments represent investment potential that influences the future. Since these institutions are a key regional economic force and are especially important to the technology sector, endowment strength can add leverage to economic development decisions.

This indicator measures the value of college and university endowments at the end of the academic year (1995-'96, 2000-'01), for reporting institutions in each region. Out of more than 500 institutions in the eight metropolitan areas examined, only 77 reported endowment value for both academic years. Typically, reporting institutions are four-year schools. Data are presented in aggregate form (total endowment) and on a per student basis.

#### Where does the Philadelphia region stand?

Philadelphia ranked third in aggregate endowment value and second per enrolled student in both periods. The University of Pennsylvania is the only local institution with an endowment greater than one billion dollars. The academic community in Philadelphia has the potential to be a significant force around the local economic development table by leveraging endowment strength and bringing to bear other resources.

Metropolitan Area Share of Total (National) Endowments (for Institutions Reporting Endowments)



Source: National Association of College & University Business Officers  
Enrollment: U.S. Department of Education

#### RECOMMENDATIONS

It is important that a portion of university endowments be allocated as risk capital at work in the local economy. Typically universities allocate some proportion (five percent or less) of total endowment to alternative assets or private equity. To maximize benefits within the region, it is important that such high-risk investing occur among local early-stage companies rather than through an investment pool outside the area, where the spillover benefits of commercialization — new companies, jobs for knowledge workers or an increase to the tax base — would not be captured locally.

**What is this indicator?**

Graduates of science and engineering programs are at the core of the Innovation Economy. The pipeline of graduating talent keeps universities and industry supplied with new researchers and skilled employees. Companies regularly cite access to a skilled workforce as critical to location decisions. Locally produced graduates are especially important, because they represent an immediately available resource that can be tapped at lower cost than graduates from outside the region.

This indicator presents the number of science and engineering degrees awarded by colleges and universities per 1,000 population for 1994 and 1998. Data are presented for doctorates, first professional degrees (such as a medical degree), master's and bachelor's degrees. Data are presented per 1,000 population to control for the varying size of each region.

**Where does the Philadelphia region stand?**

The Philadelphia region includes 71 colleges and universities with enrollment of 191,286 undergraduates and 53,002 graduate students. Philadelphia ranked third for the number of science and engineering doctorate and first professional degrees awarded per 1,000 population in 1994 and 1998, about twice the national average. The region ranked near the bottom of the group in both years, seventh or eighth, for bachelor's and master's degrees awarded per 1,000 students in science and engineering, near the national average.

This number of doctorate and first professional degrees awarded reflects Philadelphia's strength in medicine and the life sciences at the graduate level. Philadelphia is also home to many liberal arts, fine arts and other non-science degree programs, which account for the region's low

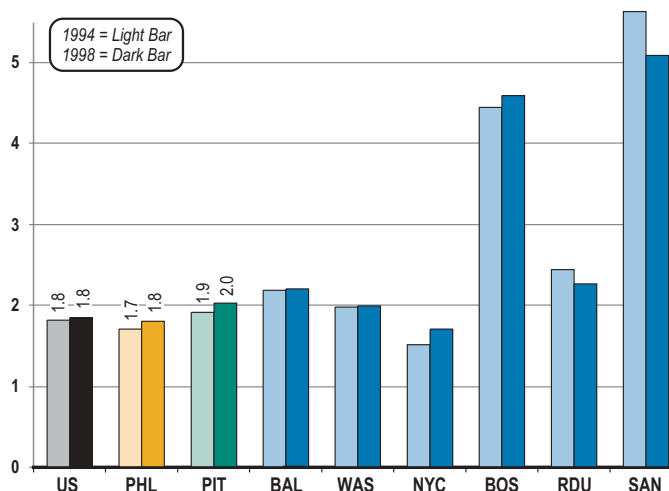
performance in granting master's and bachelor's science and engineering degrees.

**RECOMMENDATIONS**

The region's academic strengths are the diversity of institutional offerings as well as the stature of teaching and research programs. It is important not to cede either attribute, but to continue to build and rebuild in order to keep the academic pipeline full of talent. The region needs to change the local "brain drain" to "brain gain" and develop a world-class lifelong learning environment.

Innovation Philadelphia is an active member of the Knowledge Industry Partnership, a coalition of regional business, government, academic and civic organizations working together to improve connections between the region's knowledge industry — colleges and universities — and regional economic development efforts.

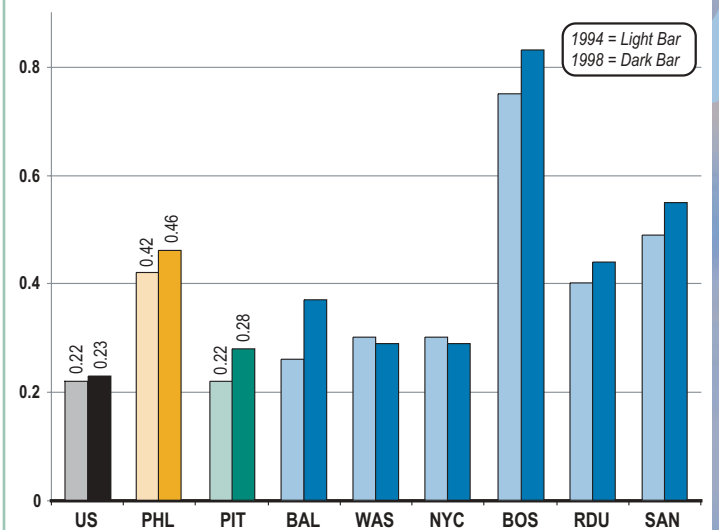
**Bachelor's Degrees in Science & Engineering per 1,000 Population**



Source: Degrees: National Science Foundation (NSF). Population: U.S. Census Bureau

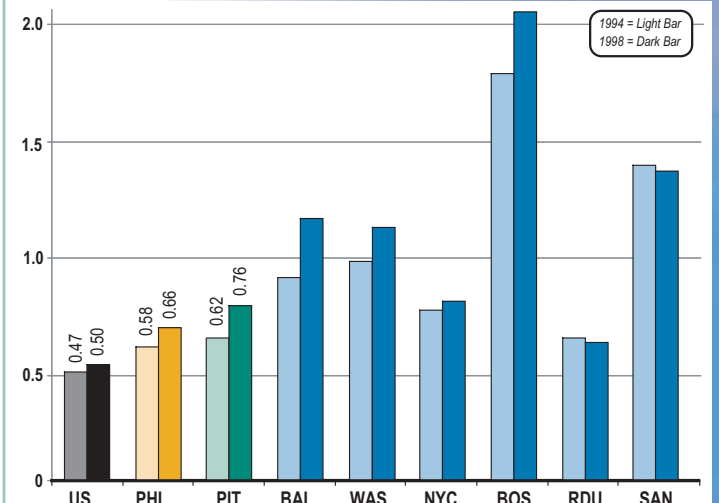
**Science & Engineering Degrees Awarded**

**PhDs & First Professional Degrees in Science & Engineering per 1,000 Population Including Medicine & Life Sciences**



Source: Degrees: National Science Foundation (NSF). Population: U.S. Census Bureau

**Master's Degrees in Science & Engineering per 1,000 Population Including Medicine & Life Sciences**

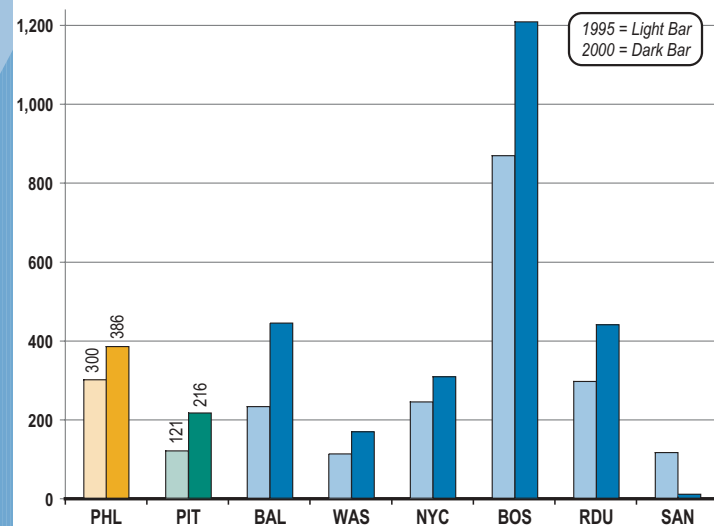


Source: Degrees: National Science Foundation (NSF). Population: U.S. Census Bureau

## Knowledge Indicator 7

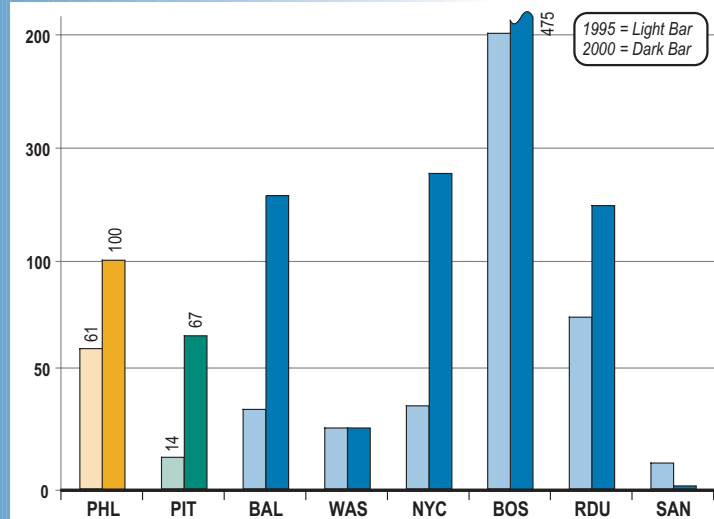
### Invention Disclosures & Patents Filed by Research Institutions

#### Invention Disclosures Filed by Colleges & Universities



Source: Association of University Technology Managers, Inc. (AUTM)

#### Patents Issued to Colleges & Universities



Source: Association of University Technology Managers, Inc. (AUTM)

#### What is this indicator?

Commercial success that originates in academia and spills over to the local economy begins with invention disclosures and patent filings. These are among the earliest measures of the vitality of the technology transfer process. There is evidence in the literature that suggests these measures correlate with funding levels for university R&D. In general, more investment in university R&D yields more patents and disclosures, which in turn have the potential to result in more commercialization and spinout activity. Since not all disclosures result in patents, disclosures typically outnumber patents for a given institution.

This indicator presents invention disclosures filed and patents issued to colleges and universities in 1995 and 2000.

#### Where does the Philadelphia region stand?

Philadelphia ranked second in 1995 and fourth in 2000 among the regions examined in both invention disclosures and patents issued at colleges and universities. Several of the other regions experienced faster rates of growth for both indicators over the period. All of the regions were far behind Boston for both indicators.

#### RECOMMENDATIONS

Philadelphia's relative success with technology transfer should be leveraged to bolster economic development through more commercialization and spinout activity at the same time that the technology transfer process itself is improved to increase the yield rate of patents from disclosures. Performance in this indicator can be strengthened by an infusion of new investment, new talent, expanded technology transfer initiatives and more institutions committed to technology transfer.

New investment can come from outside sources as well as the proceeds of previous commercial success. New talent can result from retaining and attracting the best and the brightest. Initiatives such as the Knowledge Industry Partnership, which links private and public organizations and academia with regional economic development efforts to reduce the brain drain, are important to this effort.

Other initiatives, such as the Mid Atlantic Commercialization Corporation, are geared toward accelerating the rate of commercialization of market-driven technologies and providing support to university applied research and technology efforts.

## Patent Productivity

### What is this indicator?

Patents issued can be used as a proxy for the level of research and innovation in a region. A patent recognizes the viability of a research discovery and sets the stage for possible commercialization. A large number of patents is an indicator of much innovative activity. Regions with a focus on innovation generate more patents in total and per scientist and engineer than other regions.

This indicator measures total number of patents issued to inventors for consecutive five-year periods, ending in 1996 and 2001, respectively. Cumulative patents for both five-year periods are presented, as well as patents per 1,000 scientists and engineers for the most recent half-decade (1997 to 2001).

### Where does the Philadelphia region stand?

Philadelphia ranked second in cumulative patents issued from 1992 to 1996 and third from 1997 to 2001. Philadelphia ranked second in number of patents per 1,000 scientists and engineers for both periods.

The Philadelphia region is a major source of innovative ideas that could ultimately lead to commercial success. Life sciences play an important role in the region's patent productivity.

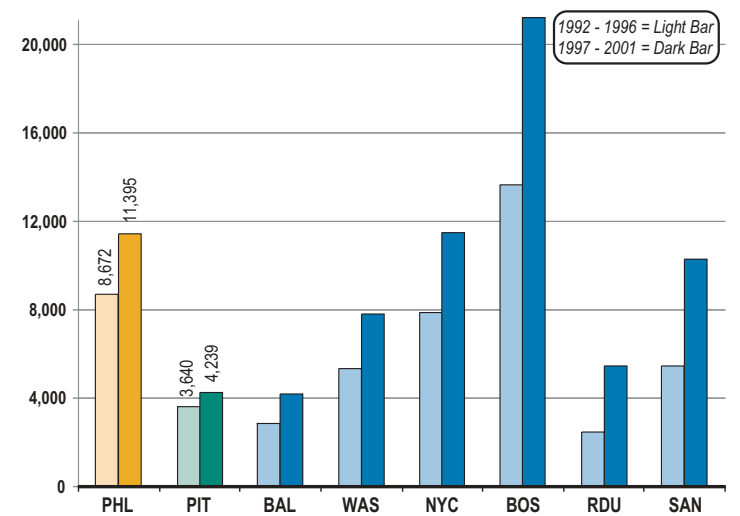
It is important to also note the strong growth of patent activity in the other metropolitan regions during the past five years. Clearly, Philadelphia cannot rest on past success alone.

### RECOMMENDATIONS

Philadelphia's solid performance in the past must continue. Patent productivity in other regions is beginning to accelerate at the same time that global economic forces are buffeting some of the key patent producers, locally — specifically pharmaceutical companies.

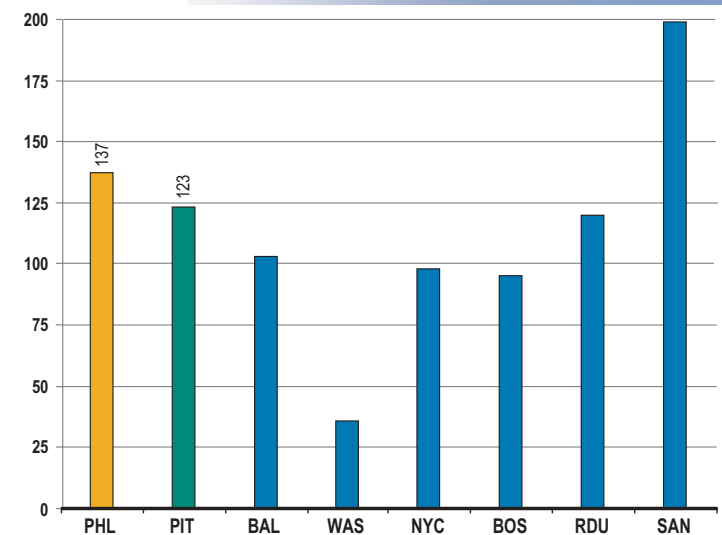
Future success in this indicator means providing the right mix of assets and eliminating constraints so that innovation can flourish in existing companies as well as newly formed start-ups — for example, in the biotechnology sector.

Total Patents Issued in Five-Year Period



Source: Number of patents: CHI Research Inc.  
Number of Scientists & Engineers: U.S. Department of Labor

Aggregate Patents per 1,000 Scientists/Engineers, 1997 to 2001

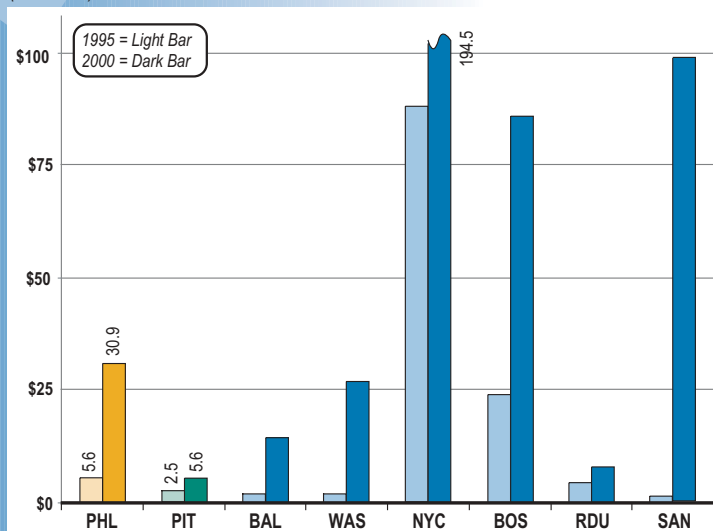


Source: Number of patents: CHI Research Inc.  
Number of Scientists & Engineers: U.S. Department of Labor

## Knowledge Indicator 9

# Royalty & Licensing Income to Universities

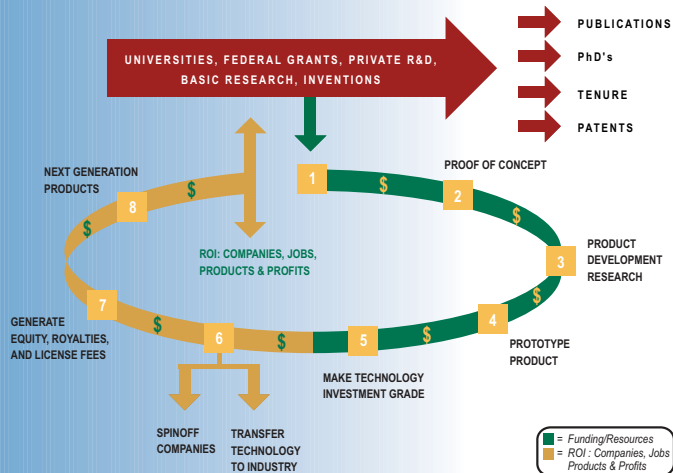
**Gross License Income (Royalties) Received by Research Institutions**  
(\$ millions)



Source: Association of University Technology Managers Inc. (AUTM)

## Innovation Philadelphia Commercialization Model

Successful Investment is the Foundation of a Successful Commercialization Model



Source: Innovation Philadelphia

## What is this indicator?

Royalty and licensing income measures the value assigned to intellectual property as technology transfers from campus out through the economy toward commercialization. Technology transfer is not the same as commercialization, however. Commercialization that occurs locally, results in spillover benefits to the local economy, such as new companies, jobs for knowledge workers and new tax revenues. Intellectual property can also be licensed far from the region where it was originally produced, in which case local spillover benefits are negligible.

Institutions can exert great influence through the successful commercialization of ideas that originate on campus. Locally, life science companies such as Centocor, Cephalon and Neose Pharmaceuticals, show the potential of homegrown commercialization and start-up activity.

This indicator presents gross license income accruing to universities for 1995 and 1999.

## Innovation Philadelphia's Commercialization Model

The chart to the left illustrates Innovation Philadelphia's virtuous circle of commercialization. IP seeks to maximize returns for both the researcher/scientist/inventor and the local economy. IP provides support or assistance for researchers throughout the process of development, technology transfer, commercialization and reinvestment.

During the early stages of discovery, feasibility analysis, proof-of-concept and prototype development, (Steps 1-5 on the chart), IP provides the resources and networking to help secure government and private funding and provides a network of business advisors who can help launch ideas and businesses.

Once a company is viable or technology is transferred (Step 6), it begins to generate royalties, profits or equity (Step 7). IP helps successful researchers/entrepreneurs utilize those gains to reinvest and begin work on the next generation of technology spinouts (Step 8). Such reinvestment keeps spillover benefits local and creates greater public return in addition to private benefits.

IP's assistance throughout the commercialization life cycle process helps more ideas lift off of paper and leave the laboratory while remaining part of the local economy, thus producing more direct and indirect benefits to the community.

## Where does the Philadelphia region stand?

Philadelphia ranked third in gross license income at the beginning and end of the period. As measured by this indicator the royalty income accruing to intellectual property generated on local campuses is not particularly high.

## RECOMMENDATIONS

Besides increasing the number of licensing deals and the value of individual deals, the Philadelphia region's performance can be improved by commercializing university technology and licensing it locally to existing companies and to start-ups spun from the university technology transfer process.

Specific initiatives such as the Mid Atlantic Commercialization Corporation accelerate the rate of commercialization of market-driven technologies and provide support to academic applied research in the region.

## Start-up Companies Formed from University Research

### What is this indicator?

Commercial success that originates in academia may or may not generate new business starts. Technology spillover from academia to the commercial sector that does not result in start-up activity can be licensed to companies anywhere in the world. In recent years, however, new companies formed around technology originating inside academic institutions — especially biotechnology and computing — have generated much excitement and commercial success. When spun out locally, start-ups create new jobs for knowledge workers and expand the tax base, as they grow and vie for profitability. Locally, Centocor, Cephalon and Neose Pharmaceuticals are three examples that show the potential of homegrown start-ups spun out of university technology.

This indicator presents the number of start-up companies formed based on university research in 1995 and 2000.

### Where does the Philadelphia region stand?

Philadelphia ranked third at the beginning of the period and sixth at the conclusion in number of start-up companies formed around university technology. The other regions under examination experienced growth over the period, most of it quite rapid, while Philadelphia experienced decline. All of the regions lagged far behind Boston.

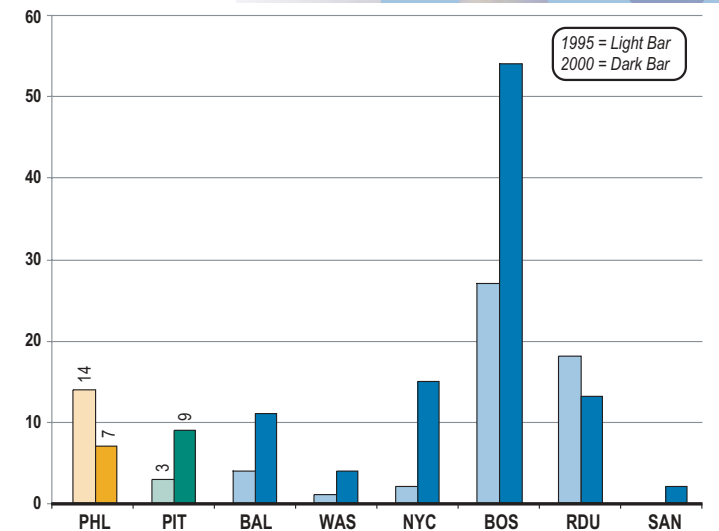
While there is no reason that the number of start-ups should rise continually, Philadelphia's success with technology transfer, as based on other indicators, does not generate a comparable level of new business activity, which can pose obstacles in the way of fostering an entrepreneurial climate.

### RECOMMENDATIONS

The local region's great strength in academic R&D, especially life sciences, must spin out more start-up companies. Local universities have shown a proclivity for basic rather than applied research, in the past. They have also shown more strength in technology transfer, than in commercialization. In particular for life science companies, the risk profile is steep — commercial success is not guaranteed even after consuming substantial time and huge capital resources — but more start-ups should yield greater commercial and economic success in later years.

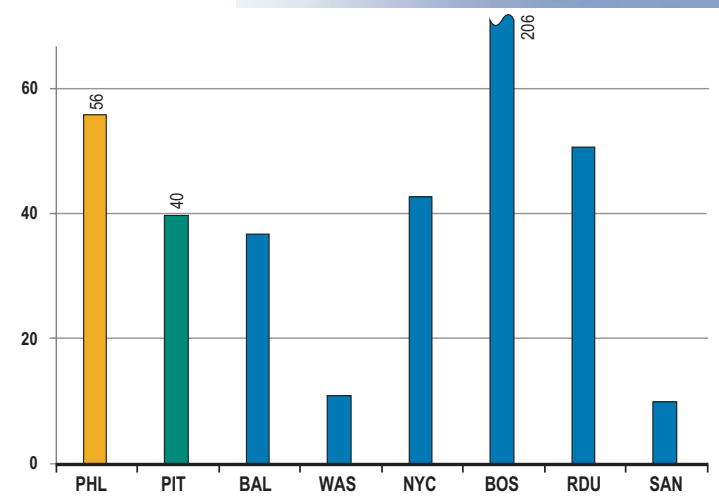
Specific initiatives like the new Mid Atlantic Commercialization Corporation accelerate the rate of commercialization of market-driven technologies and provide support to university applied research and technology efforts.

Start-up Companies Formed from University Research




Source: Association of University Technology Managers Inc.(AUTM)

Total Number of Start-up Companies Formed from University Research, 1995 - 2000



Source: Association of University Technology Managers Inc.(AUTM)



**“The importance of money flows  
from it being a link between  
the present and the future.”**

**John Maynard Keynes**  
British Economist

# CAPITAL Overview

Innovation is at the heart of the Innovation Economy. There are many ways to judge and encourage the quality of innovation. Thomas A. Edison recognized the hard work and tenacity that goes into successful innovation when he insightfully said, “Genius is one percent inspiration and ninety-nine percent perspiration.” But to persevere takes time and costs money. Without either, ideas truly are a dime a dozen — plentiful but never brought to fruition.

## **Federal Programs**

The federal government is a bountiful source of early stage capital to assist entrepreneurs and help researchers move ideas from the laboratory closer to commercial success. A number of programs exist that provide funds on a competitive basis and allow researchers at least momentary rest from the persistent need to raise capital so that they may fine tune technology, complete market research and advance business strategy. These include the Small Business Innovation Research (SBIR) program, Small Business Technology Transfer program (STTR), and Advanced Technology Program (ATP). The goals of these programs are commercial success and public benefit.

Unfortunately, Philadelphians have not made as much use as they could — or should — of the federal programs that are available

## **Other Financing Issues**

The free market provides additional opportunities to foster innovation and spawn commercial successes through venture capital and public capital markets. These structures balance risk against reward and strongly encourage innovation. A corollary is that innovation begets more innovation when the risk-reward mechanism turns out successes.

Philadelphia investments do not always receive the requisite amount of risk capital to achieve commercial success and thereby

make the region more competitive in the Innovation Economy by increasing opportunities for knowledge workers.

## **Growing the Local Innovation Economy**

Each of the above mechanisms feeds the innovation pipeline. Regions that are rich in such resources have greater potential for economic success as a result of the continual churn of idea generation and creation — that is, acting to turn laboratory ideas into commercial realities. Entrepreneurs, who are shrewd risk-takers and opportunists by nature, recognize those facts, so the feedback loop is complete and self-perpetuating: If a region rewards risk-taking, it will encourage successful risk-takers. They will be homegrown and they will migrate from elsewhere to cluster in such regions. And, most importantly, they will stay and add to the success of the region.

## **RECOMMENDATIONS**

1. The State and region must become more aggressive at applying for and winning competitive federal small business research investment awards.
2. The State and region must increase the total pool of risk capital available locally, especially angel, pre-seed, seed and early stage funds. It is important that adequate funds be available to capitalize emerging technology businesses throughout their life cycles. Tax credits and other tax policy are important tools for increasing the available pool of risk capital. Industry, academia and government must all participate to create effective tax legislation.
3. Effective business assistance programs must be made available to local start-ups to increase their prospects for commercial success and raise the amount of outside capital they are able to attract.

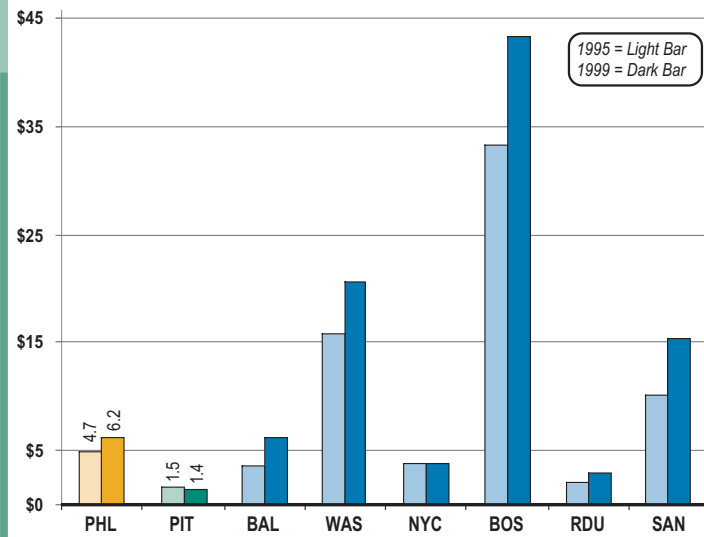
## **IP Economic Stimulus Fund**



# Capital Indicator 11

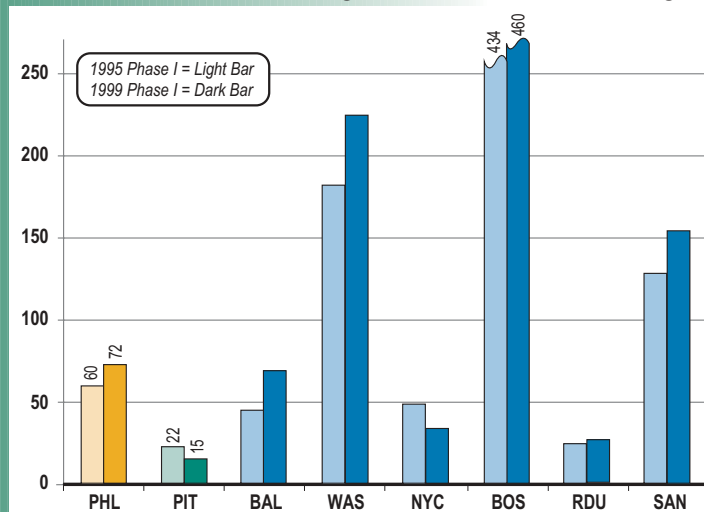
## SBIR & STTR Awards

Total Funding for SBIR & STTR Phase I (\$ millions)



Source: U.S. Small Business Administration

Total Number of Firms Receiving SBIR & STTR Phase I Funding



Source: U.S. Small Business Administration

### What is this indicator?

The federal government's Small Business Innovation Research (SBIR) Program provides competitive grants in two phases to entrepreneurs seeking to conduct proof-of-concept (Phase I) research for technical merit and feasibility and prototype development (Phase II). Success in Phase I is no guarantee of success in the second phase but there is a relationship. The Small Business Technology Transfer (STTR) Program is a similar but smaller program aimed at partnerships between small business and nonprofit research institutions, including universities.

Both programs are important sources of financing for entrepreneurs. They are the purest form of public venture capital, with virtually no strings attached — no equity dilution, no repayment, no ceding intellectual property rights and no personal guarantees. For many start-up companies, they constitute the initial revenue stream and make the difference between “go” and “no-go” decisions. Phase I provides up to \$100,000, and Phase II awards are up to \$750,000 or \$500,000 for SBIR and STTR, respectively. The SBIR and STTR programs provide \$1.5 billion for commercialization of new products and processes.

Nationally, companies that receive funding from Phase II of the SBIR program outperform similar companies that do not receive such support. Program participants can leverage the credibility associated with the award and the experimental data developed through their research to attract strategic partners and outside capital.

This indicator measures Small Business Innovation Research (SBIR) and Small

Business Technology Transfer (STTR) Phase I and Phase II grants awarded in 1995 and 1999. Data are presented for total number and total dollar value of awards.

### Where does the Philadelphia region stand?

Philadelphia ranked fourth in total number of Phase I proposals funded in 1995 and 1999, as well as total number of Phase II proposals funded in 1999. The region ranked fourth in Phase I dollars awarded in 1995 and fifth in 1999. Philadelphia ranked fourth for total value of Phase II awards in 1999.

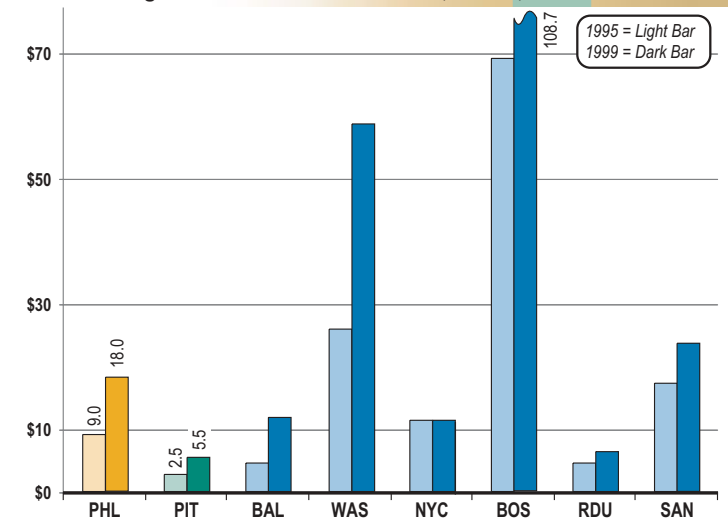
Philadelphia's middle-of-the-pack standing with respect to SBIR and STTR awards is of concern, given each programs' role in new business formation as a source of federal dollars and as a due diligence mechanism or filter for outside partners.

“ *Innovation Philadelphia’s Research Dollars program delivers a critical business tool for regional technology companies that need access and information on federal funding programs to help their businesses grow.*

*By increasing the number of federally funded proposals and leveraging federal and state funding awards, we can help emerging technology companies deliver new technology to market and create high paying jobs in the region.*”

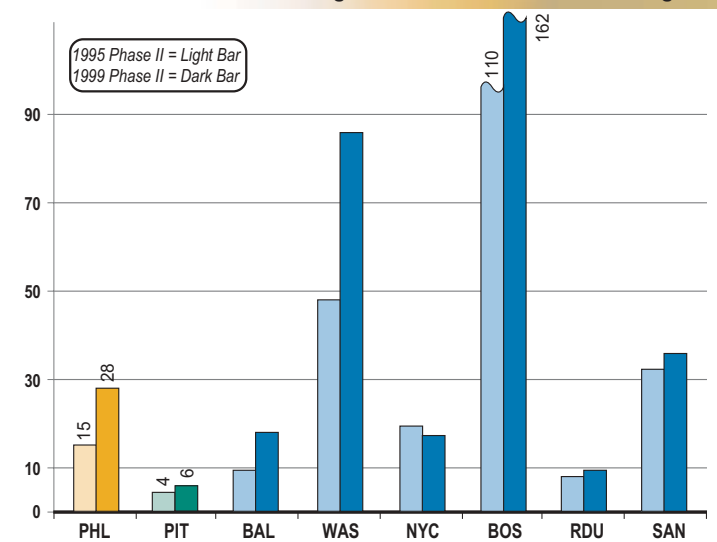
Philadelphia Mayor John F. Street

Total Funding for SBIR & STTR Phase II (\$ millions)



Source: U.S. Small Business Administration

Total Number of Firms Receiving SBIR & STTR Phase II Funding



Source: U.S. Small Business Administration

**RECOMMENDATIONS**

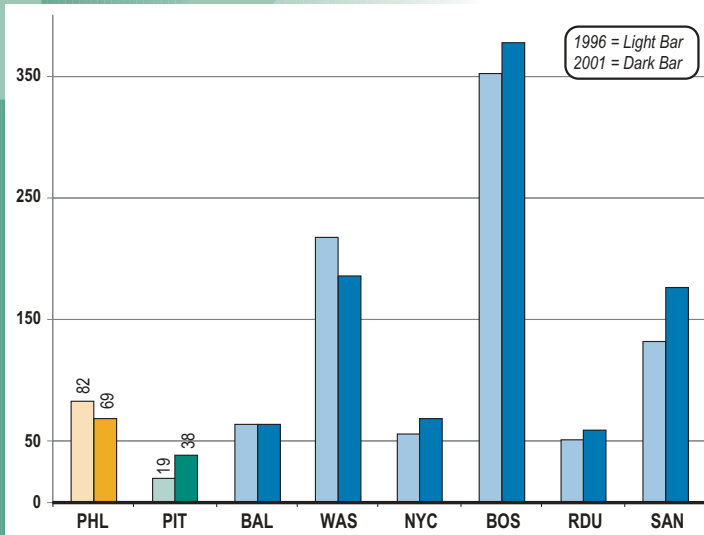
The State’s and region’s performance in terms of SBIR and STTR activity must increase. The barriers that exist to writing and submitting competitive program applications must be removed. While more applications should result in more awards, the quality of the applications must also be enhanced at the time of production to increase the yield. The more funded SBIR & STTR projects in the pipeline, the greater the likelihood of later stage commercial success.

Innovation Philadelphia’s Research Dollars program is designed specifically to increase the quantity and quality of regionally generated federal grant proposals by technology-driven businesses.

## Capital Indicator 12

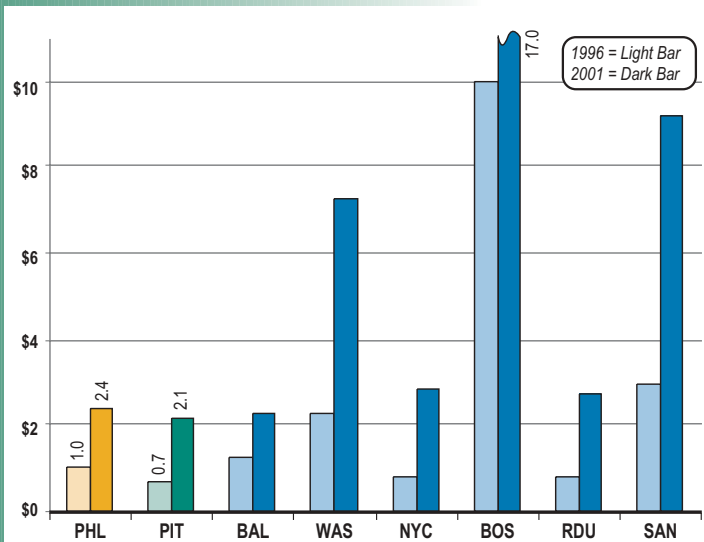
### NIH SBIR & STTR Proposals & Awards

Total Number of NIH SBIR/STTR Phase I Proposals



Source: National Institutes of Health (NIH)

NIH SBIR/STTR Phase I Award Dollars (\$ millions)



Source: National Institutes of Health (NIH)

#### What is this indicator?

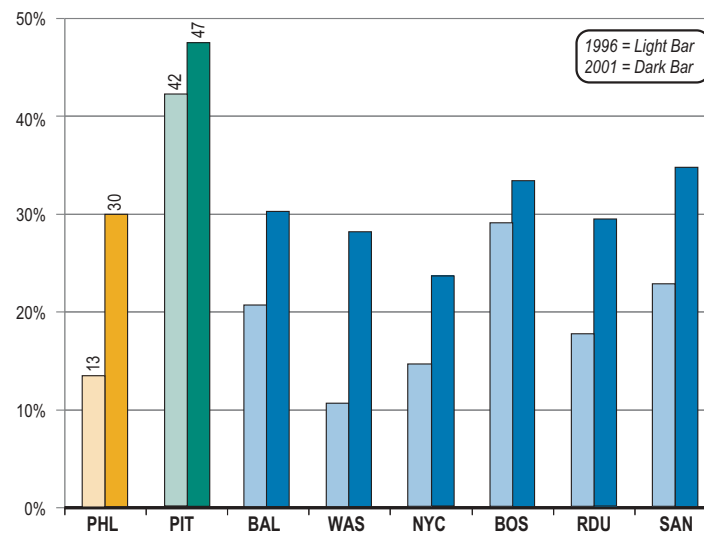
More than one-third of all Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) awards in 1999 were made by the National Institutes of Health (NIH). These grants are an important source of early-stage financing for emerging life sciences companies. These programs represent the purest form of public risk capital available, with no strings attached. There is no equity dilution, no repayment, no intellectual property giveaway and no personal guarantee. Program participants are able to leverage the credibility associated with an award and the experimental data developed through their research, to attract strategic partners and outside capital.

The SBIR Program provides competitive grants to entrepreneurs seeking to conduct

proof-of-concept research (Phase I) and prototype development (Phase II). The STTR Program is similar but smaller and aimed at partnerships between small business and nonprofit research institutions, including universities. Phase I provides up to \$100,000, and Phase II awards are up to \$750,000 or \$500,000 for SBIR and STTR, respectively — or \$850,000 for combined NIH SBIR Fastrac awards.

This indicator measures NIH Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Phase I and Phase II proposals and grants awarded in 1996 and 2001. Data are presented for total number and total dollar value of awards, as well as the yield rate — funded proposals as a share of proposals submitted. Yield is a proxy for the quality of submitted proposals.

NIH SBIR/STTR Phase I Yield Rate



Source: National Institutes of Health (NIH)

## Where does the Philadelphia region stand?

Philadelphia's performance places it in the middle of the group for most of these indicators. The region did experience a notable increase in the yield rate for Phase II proposals by the end of the period.

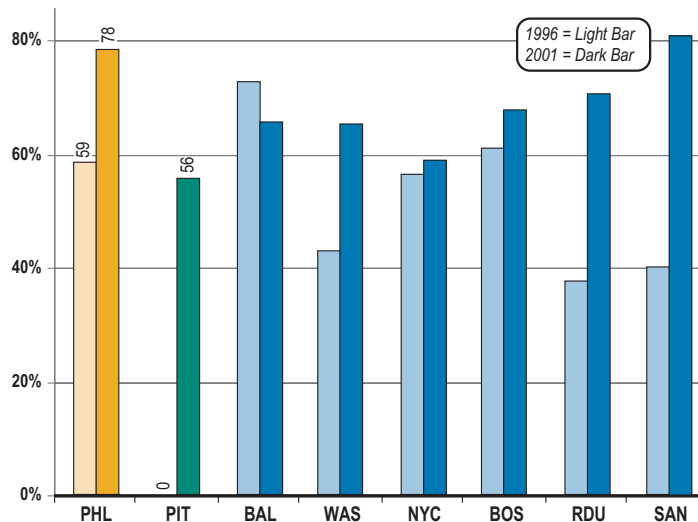
Philadelphia's middle-of-the-pack standing with respect to SBIR and STTR awards is of concern, given the programs' roles in new business formation, both as a source of federal dollars and as a due diligence mechanism for outside partners. Given the high cost in dollars and time to create successful life sciences companies, an increase in activity at the earliest stages — corresponding to an increase in SBIR and STTR activity — is likely to improve later stage success.

## RECOMMENDATIONS

As with the other SBIR and STTR programs, the absolute number of applications being submitted from within the State and region must increase. The barriers or constraints to completing funding applications must be removed. Application quality should be enhanced before submission in order to increase the yield. The more funded SBIR and STTR projects in the pipeline, the greater the probability of later stage commercial success.

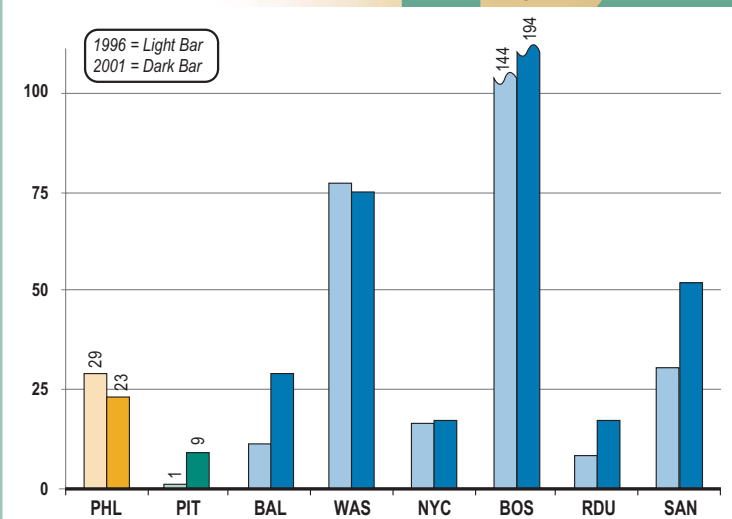
Innovation Philadelphia's Research Dollars program is designed to specifically increase the quantity and quality of regionally generated federal grant proposals by technology-driven businesses.

### NIH SBIR/STTR Phase II Yield Rate



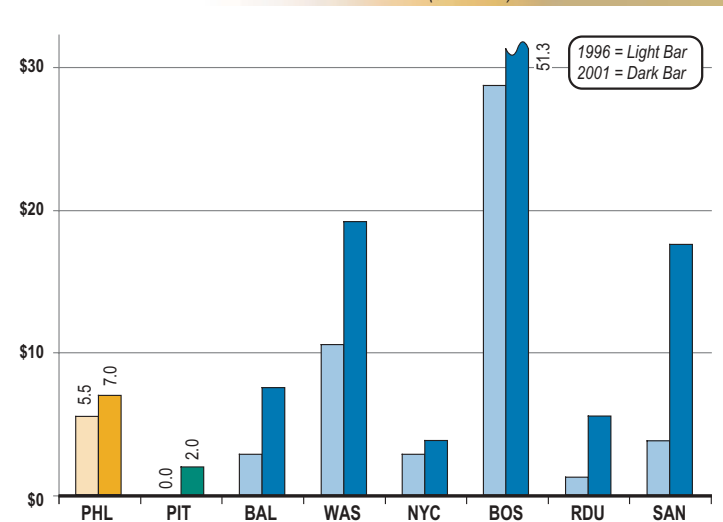
Source: National Institutes of Health (NIH)

### Total Number of NIH SBIR & STTR Phase II Proposals



Source: National Institutes of Health (NIH)

### NIH SBIR/STTR Phase II Award Dollars (\$ millions)

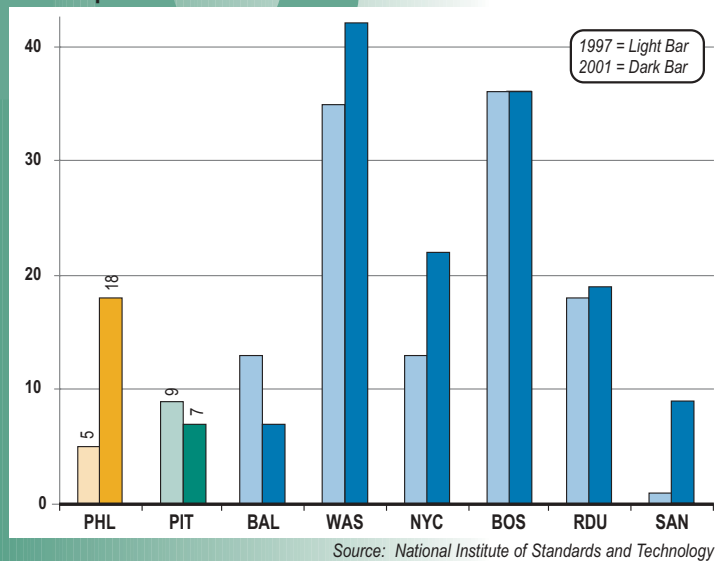


Source: National Institutes of Health (NIH)

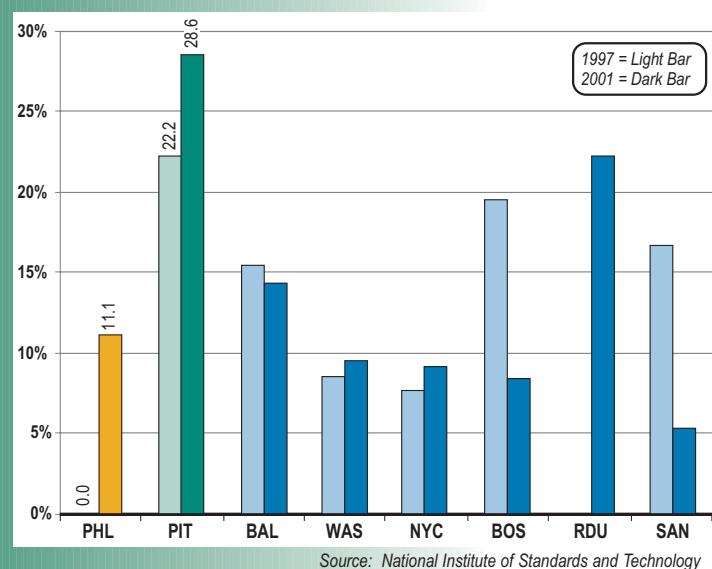
## Capital Indicator 13

# Advanced Technology Program (ATP) Proposals & Awards

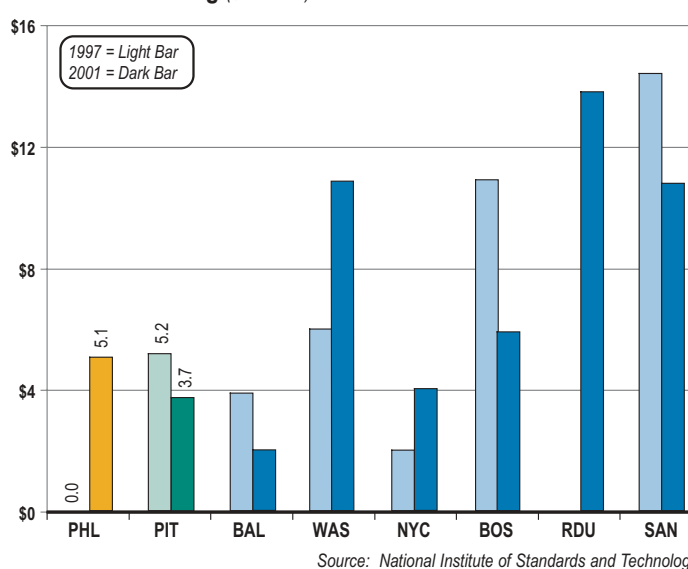
### ATP Proposals Submitted



### ATP Yield Rate



### ATP Award Funding (\$ millions)



### What is this indicator?

The Advanced Technology Program (ATP) is a federal program that supports technology entrepreneurs. Like other federal programs, such as SBIR and STTR, ATP is an important source of early stage funding. The program also serves as a due diligence filter for outside and follow-on capital. It is geared toward longer range, higher yield research. The ATP provides funding for partnerships with the private sector to advance innovative technologies that promise significant commercial payoffs and widespread benefits for the nation. Many partnerships include academic researchers. Since 1990, almost 600 projects and 1,300 participants — including 150 universities and 25 national laboratories — have received \$1.8 billion of ATP funding, with 61 percent of the projects led by small businesses. The ATP terms require no

intellectual property concessions and typically provide about \$1 million per project per year.

This indicator measures Advanced Technology Program (ATP) proposals and grants awarded by the National Institute of Standards and Technology (NIST) in 1997 and 2001. Data are presented for total number and total dollar value of awards, as well as the yield rate — funded proposals as a share of proposals submitted. Yield is a proxy for the quality of submitted proposals.

### Where does the Philadelphia region stand?

The State's and region's performance place them in the middle of the group. The region experienced a notable increase in proposals submitted by the end of the period.

### RECOMMENDATIONS

The absolute number of ATP applications and the yield rate must both increase in the region and the State. Barriers to completing applications need to be removed and application quality enhanced before submission.

Through Innovation Philadelphia's Research Dollars Program, more proposals and more awards in the pipeline should result in more commercial success stories.

## Early Stage Venture Capital Investments

### What is this indicator?

Venture capital is a critical source of funding for growth-oriented companies in the Innovation Economy. Venture capital investment is attracted to firms in industry clusters with the potential for exceptionally high rates of growth over various periods, based on the type and stage of investment. Regions with high levels of venture capital offer a healthy climate for new entrepreneurial activity.

It is important for early stage investments where the risks associated with new ventures are greatest, that venture capital should be available not just in large, multi-million dollar tranches, but also to fill the capital gap that may exist between the earliest project funding — typically self-funding and funds from friends and family members, government awards and private angel investors, which in the local region includes: Loosely Organized Retired Executives (LORE), Pennsylvania Private Investors Group (PPIG) and Robin Hood Ventures — and later, larger funding rounds.

This indicator measures total and early stage venture capital (which includes start up, seed and early stage funds) for all companies in 1996 and 2001.

### Where does the Philadelphia region stand?

Philadelphia performed near the middle of the pack, with early stage and combined funding levels that place it in fourth and fifth place at the beginning and end of the period, respectively. Just over one-fourth of the region's funding was classified as early stage in 2001, above the national average (22 percent) and the proportion for all of the benchmark regions except

Baltimore (37 percent). The proportion of companies that received early stage funding (16 companies, 36 percent of all companies funded) in 2001 was higher than the national average (31 percent) and the proportion for all of the other benchmark regions except Baltimore (nine companies; 44 percent).

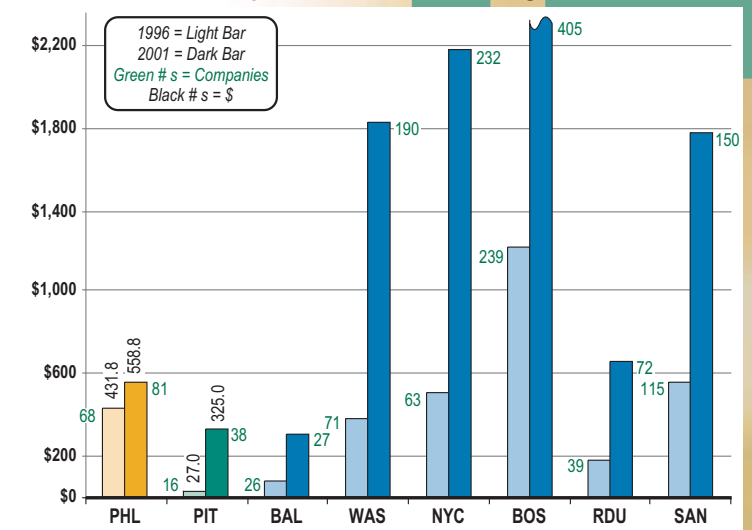
The average size early stage investment in Philadelphia in 2001 was \$5.4 million. (Average equals the sum of early stage investments divided by number of companies.) Detailed data shows that a limited number of deals received the bulk of the funds that were invested leaving relatively little to be distributed among the remaining companies in parcels of \$250,000 to one million dollars.

With venture capitalists becoming even more cautious during the past year, the situation in Philadelphia will deteriorate unless more funds are committed on a regional basis.

### RECOMMENDATIONS

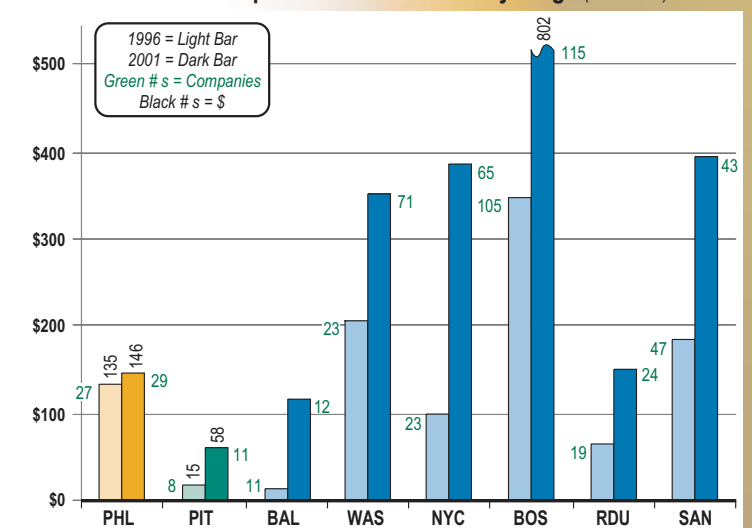
New sources of venture funding must be attracted and created. The pool of early stage venture capital invested locally must be increased. At the same time, the capital gap that exists for ventures seeking between \$500,000 and \$1.5 million must be closed. Since smaller deals result in a larger portfolio that may be more difficult to manage, the issue of risk must be addressed. Innovation Philadelphia's Mid Atlantic Angel Group (MAG) and Economic Stimulus Fund (ESF) are initiatives that address local venture capital availability.

Sum of all Venture Capital Investments – All Stages (\$ millions)



Source: Venture Economics

Sum of all Venture Capital Investments – Early Stage (\$ millions)

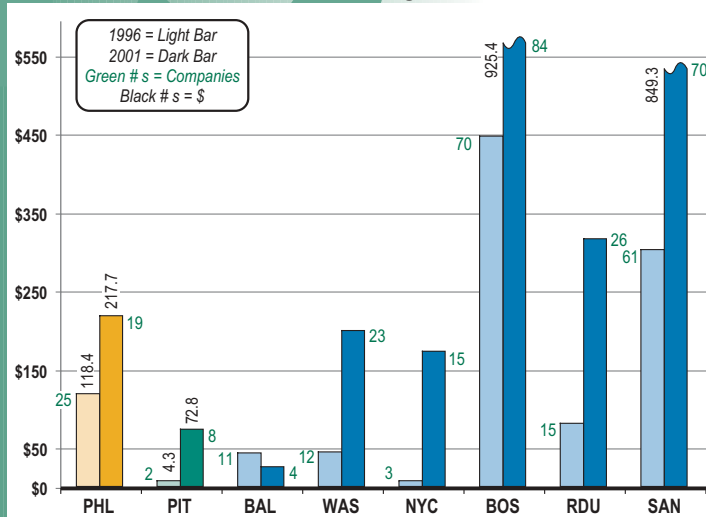


Source: Venture Economics

## Capital Indicator 15

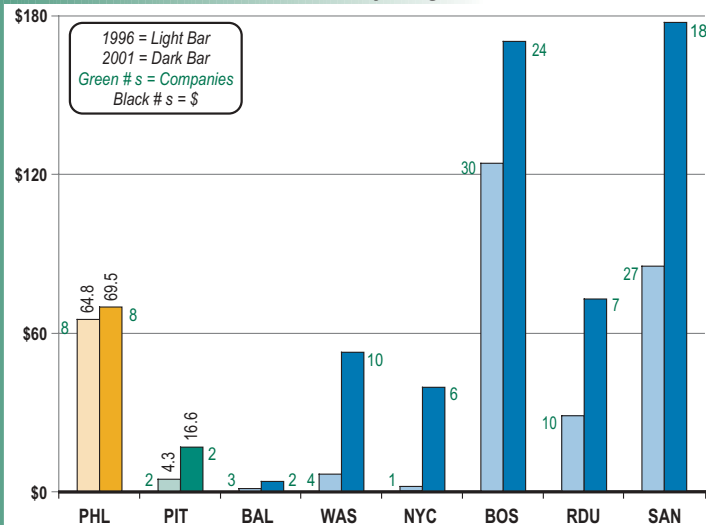
# Medical/Health/Life Science Venture Capital Investments

Sum of All Venture Capital Investments in  
Medical/Health/Life Sciences – All Stages (\$ millions)



Source: Venture Economics

Sum of All Venture Capital Investments in  
Medical/Health/Life Sciences – Early Stage (\$ millions)



Source: Venture Economics

### What is this indicator?

Venture-capital investment is attracted to firms in industry clusters with the potential for exceptionally high rates of growth over various periods, based on the type and stage of investment. The risks associated with life sciences investments are particularly high, due to the lengthy testing and regulatory process before commercialization. Many companies require substantial capital (between \$300 million and \$500 million) and many years before products are on the road toward profitability. Life sciences companies struggle for survival until the time they are profitable, so outside support remains necessary throughout their life cycles or until they go public.

It is especially important for early stage investments, where the risks associated with new companies are greatest, that venture capital should be available not just in large, multi-million dollar tranches but also to fill the capital gap that may exist between the earliest project funding — typically self-funding and funds from friends, family members, government awards and private angel investors — and later, larger funding rounds. Especially for the high-risk life sciences sector, a healthy early stage “pipeline” provides increased likelihood of later commercial success.

This indicator measures total and early stage venture capital (which includes start-up, seed and early stage funds) for medical, health and life sciences companies in 1996 and 2001.

### Where does the Philadelphia region stand?

Philadelphia performs near the middle of the pack, with early stage and combined funding levels that place it in third and fourth place at the beginning and end of the period,

respectively. Almost one-third of the region’s funding was classified as early stage in 2001, above the proportion for all of the other benchmark regions. Forty-two percent (eight companies) of all regional companies funded in 2001 received early stage funding. That proportion is near the middle of the pack (maximum: Baltimore, 50 percent; minimum: Pittsburgh, 26 percent).

The average size early stage investment in Philadelphia in 2001 was \$8.7 million. (Average equals the sum of early stage investments divided by number of companies.) Detailed data shows that a limited number of deals received the bulk of invested funds, leaving relatively little capital for the remaining companies.

Venture capitalists continued their cautious investing during the past year. The situation in Philadelphia will deteriorate unless more funds are committed on a regional basis.

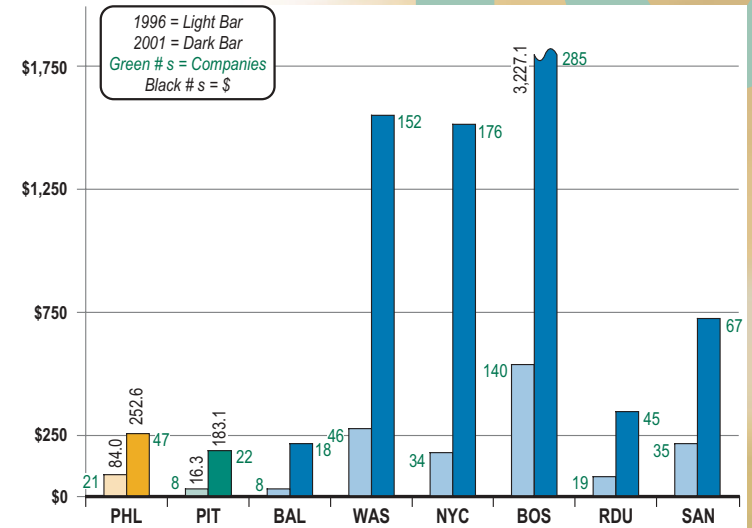
## RECOMMENDATIONS

New sources of venture funding must be attracted and created. Early-stage life sciences venture capital invested locally must be increased and the capital gap for ventures seeking \$500,000 to \$1.5 million must be closed. It is important that funding not simply be shifted from later- to early-stage, or from larger tranches to smaller tranches, but that the total amount of funds available be increased.

Innovation Philadelphia’s Mid Atlantic Angel Group (MAG) and Economic Stimulus Fund (ESF) are initiatives that address local venture capital availability.

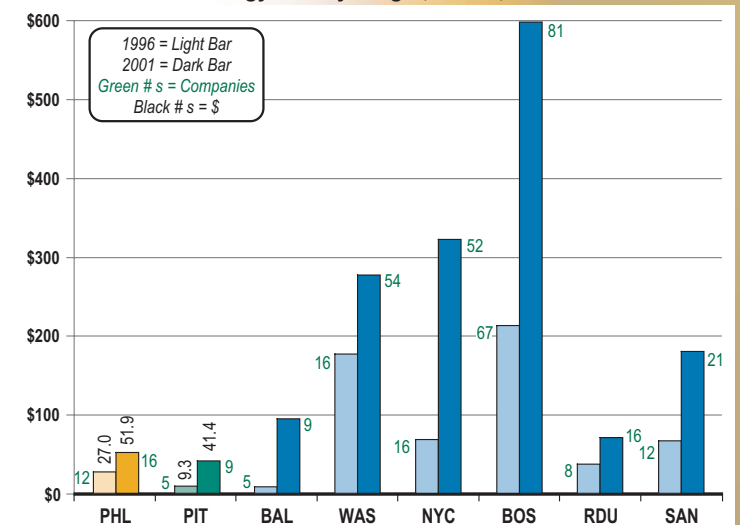
## Information Technology Venture Capital Investments

Sum of all Venture Capital Investments in Information Technology – All Stages (\$ millions)



Source: Venture Economics

Sum of all Venture Capital Investments in Information Technology – Early Stage (\$ millions)



Source: Venture Economics

### What is this indicator?

Venture capitalists invest in industry clusters that are expected to achieve above average returns during the period under consideration, based on type and stage of investment. Regions with high concentrations of venture capital generally offer a better entrepreneurial climate.

As the dot-com explosion — the boom and bust — shows, even venture capitalists may be swayed to follow the crowd. When that happens, companies or whole industry clusters may be overlooked. Public venture capital provides some counter measure to such bias. For early stage investments, where risk is particularly high, venture capital should be available to fill the capital gap that often exists between earliest project funding — from friends, family members, and angel investors, which in the local area includes: Loosely Organized Retired Executives (LORE), Pennsylvania Private Investors Group (PPIG) and Robin Hood Ventures — and later, larger rounds.

This indicator measures total and early stage venture capital (which includes start-up, seed and early stage funds) for information technology companies in 1996 and 2001.

### Where does the Philadelphia region stand?

Philadelphia performs near the middle of the pack, with early stage and combined funding levels that place it in third and fifth place at the beginning and end of the period, respectively. The region experienced an increase in venture capital committed to information technology during the period, but the growth rate was lower than for the other benchmark regions. One-fifth of the region's funding was classified as early stage in 2001, close to most benchmark regions (maximum: Baltimore, 45 percent; minimum: Washington, D.C., 18 percent). The proportion of companies that received early-stage funding

(16 companies; 34 percent of all companies funded) in 2001 was also near the middle of the pack (maximum: Baltimore, 50 percent; minimum: Boston, 28 percent).

The slower local rate of growth for information technology venture capital, is reflected by the average 2001 early stage investment in Philadelphia of \$4.3 million — about half the average size investment in Pittsburgh, the region with the next lowest average deal size. (Average equals the sum of early stage investments divided by the number of companies.) That may reflect the dominance of a single publicly traded venture investor in the Philadelphia region and the large concentration of local IT deals funded and held in that portfolio during the period.

With venture capitalists becoming even more cautious during the past year, the situation in Philadelphia will deteriorate unless more funds are committed, locally.

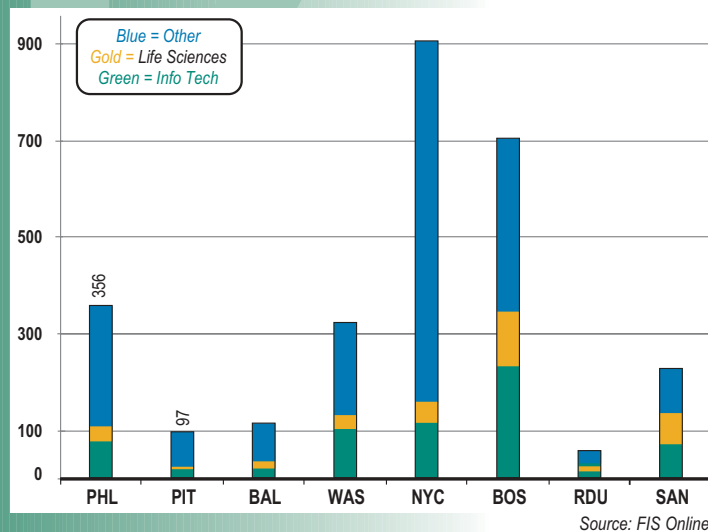
### RECOMMENDATIONS

Early stage information technology venture capital invested locally must be increased. New sources of venture funding must be attracted and created. At the same time, the capital gap that exists for ventures seeking between \$500,000 and \$1.5 million must be closed. It is important that funding not simply be shifted from later to earlier rounds but that the total amount of funds available be increased. Since smaller deals result in a larger portfolio that is more difficult to manage, the associated risk must be addressed. Innovation Philadelphia's Mid Atlantic Angel Group (MAG) and Economic Stimulus Fund (ESF) are initiatives that address local venture capital availability.

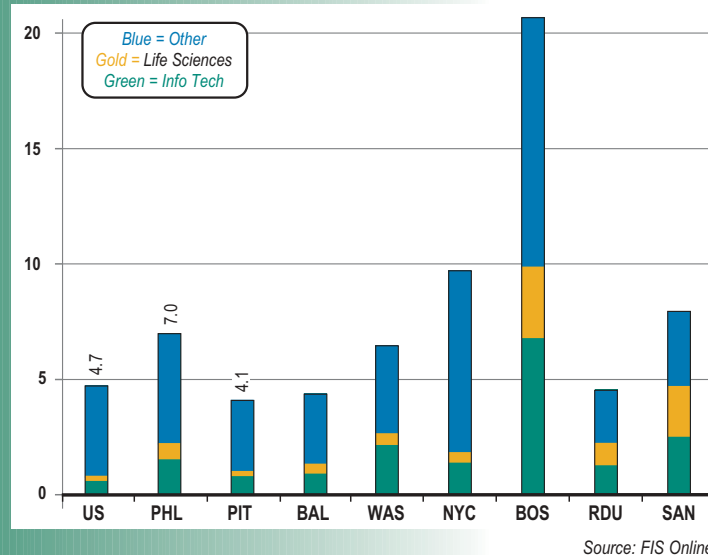
## Capital Indicator 17

### Publicly Traded Companies

Number of Publicly Traded Companies Based in Metropolitan Area, June 2002



Number of Publicly Traded Companies per 100,000 Population, June 2002



#### What is this indicator?

Company headquarters are important regional anchors for industry clusters. Regions with company headquarters also include supporting companies and are capable of spawning new support firms and spinout companies. That is particularly important for high-technology companies since they belong to the strategic industry clusters at the heart of the Innovation Economy. Finally, corporations build stronger ties, such as philanthropic and volunteer support, in the communities where they are headquartered.

This indicator measures the number of publicly traded companies with headquarters in each region as of June 2002. Data are presented in total and per 100,000 population.

#### Where does the Philadelphia region stand?

Philadelphia is third in total number of headquarters and fourth per 100,000 population, well above the national average. Based on the number of high-technology companies, Philadelphia, with 64 firms, is fifth among the group. Based on the number of biotechnology companies, the region, with 35 firms, ranks fourth. For both subgroups, the concentration per 100,000 population in Philadelphia is well above the national average.

Regional headquarters concentration is important to watch, somewhat like the canary in the coal mine. Trends over time may be indicative of overall regional economic performance. Likewise, headquarters trends for high technology and biotechnology companies are important, as these are a haven for knowledge workers and also a good measure of strategic technology cluster trends.

#### RECOMMENDATIONS

When headquarters disappear, it is important to mine the talent that remains— managerial and technical knowledge workers — to retain as many as possible and to reallocate other where necessary rather than see talent leave the region. During periods of economic turmoil, headquarters talent should be tapped to grow toward start-ups and advance those firms to commercial success. Efforts should be aimed at strategic technology clusters to encourage knowledge worker retention.

Preserving corporate headquarters and growing new firms are activities that require significant interaction with New York investment banking firms and legislators and regulators around Washington, D.C. Philadelphians should use their competitive advantage — close proximity to both cities — to cultivate and strengthen those business ties.

# Initial Public Offerings

**What is this indicator?**

Initial Public Offering (IPO) activity speaks directly to the Innovation Economy. IPOs allow companies to access public capital markets, which provide leverage and accelerate growth. IPOs are also a route to liquidity for entrepreneurs and early investors, such as venture capitalists. The proceeds of going public are typically reinvested in new venture activity — that is, new ideas and new opportunities — in a virtuous circle. Finally, IPOs are important as a measure of how well a region produces companies that investors regard as durable — long lasting and with significant growth potential.

Life sciences companies usually require larger sums of private investment, like venture capital, and a longer time before they achieve the prerequisite milestones that precede IPO and commercial success.

This indicator measures the total number of initial public offerings from 1996 and 2001, as well as total activity over that period.

**Where does the Philadelphia region stand?**

Philadelphia ranked fourth in total number of IPOs from 1996 to 2001. The regions that were ahead during that period experienced more of an IPO bubble due to the dot-com phenomenon.

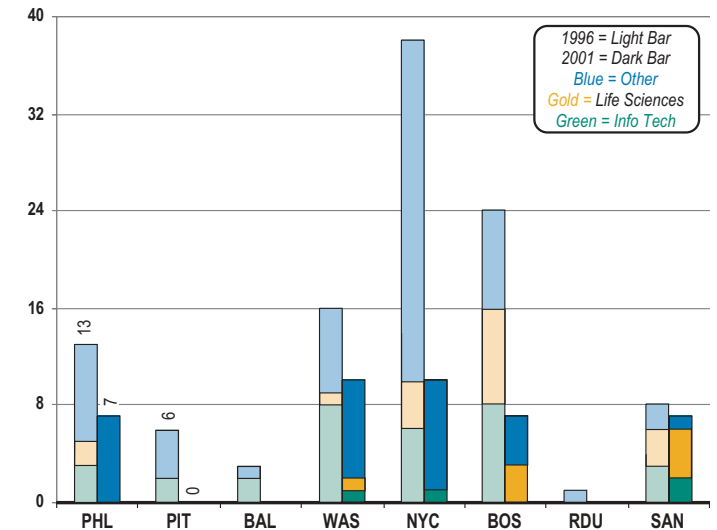
In total biotech IPOs during the period, Philadelphia, (eight IPOs) was in fourth place, behind Boston (29 IPOs), San Diego (24 IPOs) and New York City (nine IPOs). In total information technology IPOs, Philadelphia (22 IPOs) was in fifth place.

**RECOMMENDATIONS**

The stage needs to be set for more IPO activity. Philadelphians should utilize their competitive advantage — close proximity to the investment banks and the venture capitalists of New York City and the Washington, D.C. area — to strengthen those business relationships.

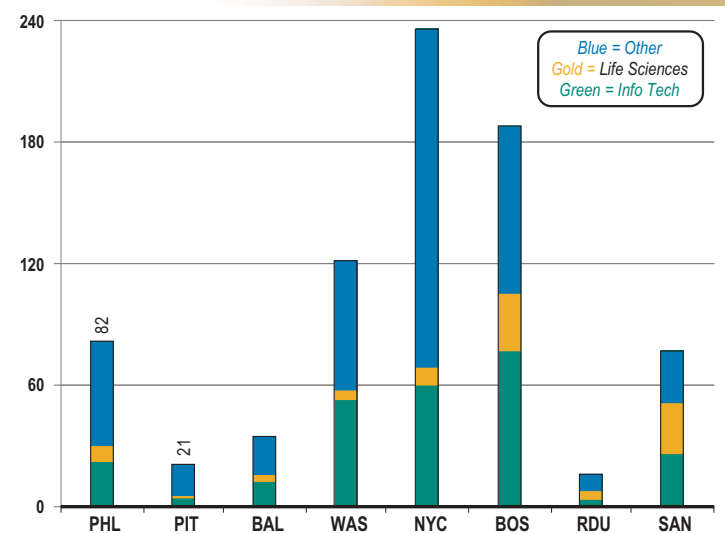
Innovation Philadelphia is engaged in several initiatives that will ultimately increase local IPO activity, including its work to create the Mid Atlantic Commercialization Corporation — which will link technology transfer resources and assist in the commercialization of strategic technologies — and the creation of Research Dollars — which will provide support for federal technology commercialization award applicants (such as SBIR, STTR and ATP).

Trend in IPOs



Source: Alert- IPO! Online

Total IPOs 1996 to 2001



Source: Alert- IPO! Online



**“...Greater Philadelphia ‘the buckle of the money belt’  
– halfway between the international financial capital (New York City)  
and the country’s seat of public capital (Washington, D.C.).”**

**Bruce Katz**

Director, Brookings Institute’s Center on Urban and Metropolitan Policy  
Building a Competitive Philadelphia

*Speech to Pennsylvania Biotechnology Association, October 10, 2001  
as quoted in the report, The State of the Venture Community in the Greater Philadelphia  
and the Mid-Atlantic Market, produced by The Greater Philadelphia Venture Group*

# LOCATION Overview

Regions that are — or will become — economic success stories regionally, nationally and internationally have other requirements and must possess other positive characteristics besides those in the Knowledge and Capital sections of this report. They must provide a continually replenished pool of skilled and semi-skilled knowledge workers from which companies can derive necessary talent. They must possess the necessary infrastructure, such as high-speed Internet capacity, and must be globally connected to markets, suppliers, regulators, financiers and others.

Since perception often shapes reality, successful economic regions must be portrayed positively. Success often begets success. The opposite is also true. Any image that is portrayed has the potential to be self-fulfilling. It is easier to enhance and build upon a positive image, but it is just as important to overcome negative perceptions — witness the many cycles that Los Angeles and New York have gone through.

The indicators in this section pertain to perception and reality regarding location. Some of them try to rank regions. Others are based on indicators that are specific and objective. In every case, indicators reflect the past but also have the potential to influence the future. Indicators are also subject to influence and can be changed over time. That is the ultimate objective of this report — to improve the Commonwealth's and Philadelphia's standing in the Innovation Economy.

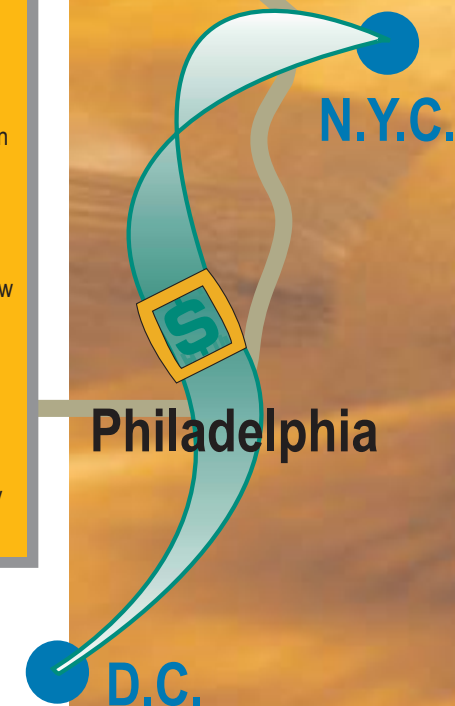
Philadelphia is uniquely positioned to be the North American headquarters for a number of global companies. It can serve as gateway to much of the developed world. Unlike other U.S. cities, it is situated halfway between the private financial capital of the world, Manhattan, and the nation's capital, Washington, D.C., seat of government, regulatory agencies, and public funding.

It is necessary to change perceptions about Philadelphia. The city is already a global competitor, even if that image is not held by everyone, local or outsider. Image enhancement, such

as the "Positively Philadelphia" consortium provides, will help to change the view from outside the region. Locally, the Knowledge Industry Partnership, which links the region's knowledge industry of colleges and universities with regional economic development efforts, is working to change the view from inside the region and to change the "brain drain" to "brain gain" in the process.

## RECOMMENDATIONS

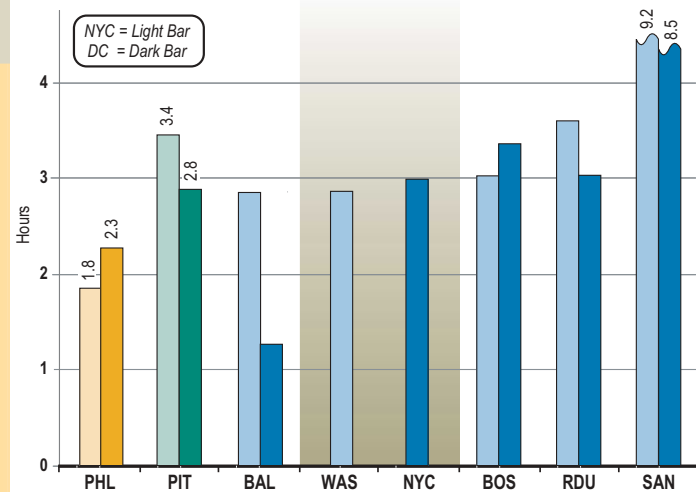
1. Philadelphia must capitalize upon the great competitive advantage of its location as a global gateway, and network to strengthen relationships in Harrisburg, New York and Washington, D.C.
2. The State and region must strengthen the connections between industry and academia, to address future workforce needs, create world-class lifelong learning opportunities and improve collaborations that lead to the commercialization of academic applied research.
3. The State and region must create a vibrant environment for new business start-ups, for retaining and growing existing businesses and for recruiting firms in strategic technology clusters.
4. The State and region must enhance the image of the Commonwealth and Philadelphia as global leaders in the Innovation Economy, at home and globally, and must aggressively promote Pennsylvania and Philadelphia as quality places to live and conduct business.



## Location Indicator 19

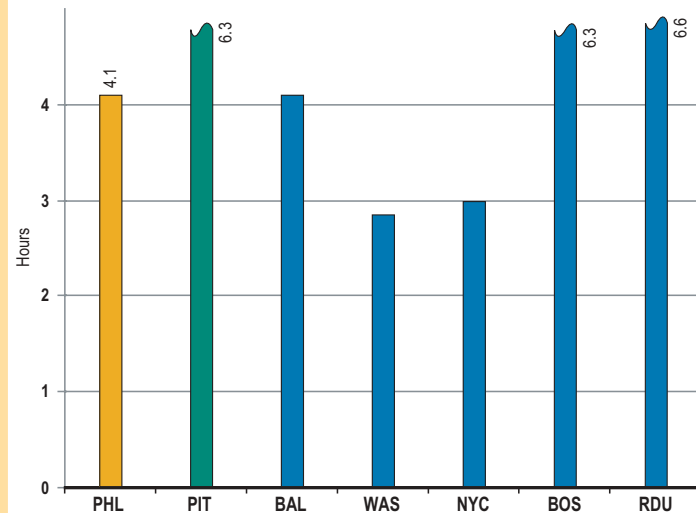
### Transport Time to D.C. & N.Y.C.

Shortest Travel Time to N.Y.C. or D.C. by Plane or Train:  
Business District to Business District, July 2002



Source: OAG Inc.; Amtrak

Total Travel Time to both N.Y.C. or D.C. by Plane and Train:  
Business District to Business District, July 2002



Sources: OAG Inc.; Amtrak

#### What is this indicator?

Convenient access to capital, legislators and regulators are important criteria for entrepreneurs and businesses in the Innovation Economy. For example, many early stage investors prefer to invest in companies they can reach in less than two hours. That makes it easier to provide hands-on management when necessary. Life sciences companies and many larger businesses also require proximity to regulators, clients and partners.

Philadelphia enjoys the best proximity to Manhattan and Washington, D.C., of any major city in the United States. Philadelphia is like “the buckle of the money belt” of the nation, between Manhattan — center of the private capital world— and Washington, D.C. — locus of a significant amount of public capital available for research and commercialization. The D.C. metro area is also the center of regulatory, lobbying, and legislative activity, and is extremely important for high-technology clusters like biotechnology.

This indicator measures travel time from each region’s central business district to the business districts of New York City and Washington, D.C., individually, as well as the combined travel time between New York, Washington and each region’s central business district.

#### Where does the Philadelphia region stand?

Travel time from Philadelphia is about two hours door-to-door to New York City and to Washington, D.C. Even single day trips between Philadelphia and both destinations

can be arranged without difficulty. No other city on the list offers such convenience to both destinations. Proximity is an asset when marketing the region to out-of-area firms. It is also a quality of life attribute when marketing to knowledge workers.



#### RECOMMENDATIONS

Convenient access to and from Philadelphia is a positive feature that needs to be promoted when the region is marketed to companies and knowledge workers. Philadelphia is in an attractive geographic location for companies to establish North American headquarters. Through its participation in “Positively Philadelphia” and other outreach activities, Innovation Philadelphia is in position to do just that.

# Non-Stop Destinations Served

### What is this indicator?

Mobile phones, faxes and the Internet notwithstanding, most business still requires human connectivity — face-to-face meetings and personal interaction between clients and colleagues. That is the case for regional, national and international business, where proximity and access remain issues. A convenient airport with non-stop routes all over the world is important for a region to remain competitive. Otherwise, business costs are increased by the inconvenience of traveling outside the area to begin most trips.

This indicator measures how many domestic and international destinations are served by non-stop flights originating at major airports in each region.

### Where does the Philadelphia region stand?

Philadelphia ranks third among the eight regions in domestic and international destinations served by non-stop flights. Philadelphia International Airport (PHL) is easily accessed from the region's major business centers. The region also provides reasonably convenient access to other major airports, such as Newark and Baltimore-Washington International Airport, and several smaller regional airports, including those in Trenton, Harrisburg, and Atlantic City.

Philadelphia International Airport is not large in terms of passenger volume. It is the nation's 19th largest airport in total passenger departures, serving 85 domestic and 26 international cities. Low volume combined with good accessibility are attractive features that can be marketed as assets for the region.

### RECOMMENDATIONS

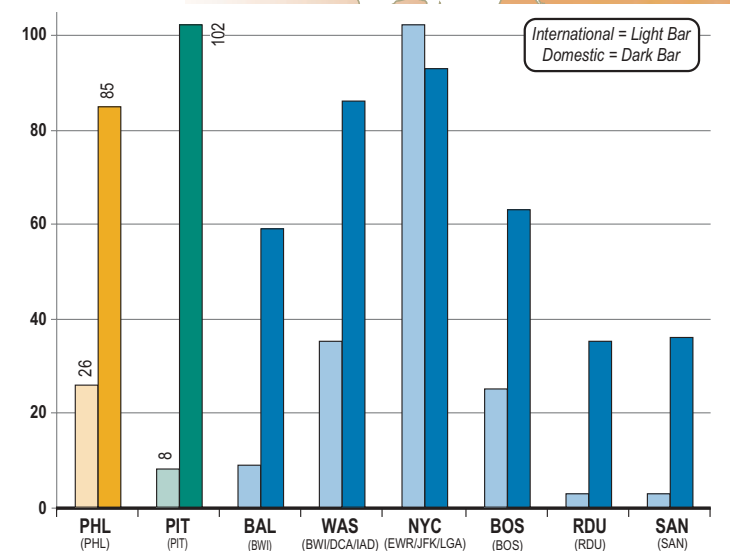
Philadelphia definitely has the location and transportation resources to compete globally. Convenient access to and from Philadelphia is a positive feature that needs to be promoted when the region is marketed to companies and knowledge workers. The region must protect this asset by keeping operations at Philadelphia International Airport viable.

Innovation Philadelphia is in a position to market the region through participation in "Positively Philadelphia" and other outreach activities.

*"No nation was ever ruined by trade."*  
Benjamin Franklin



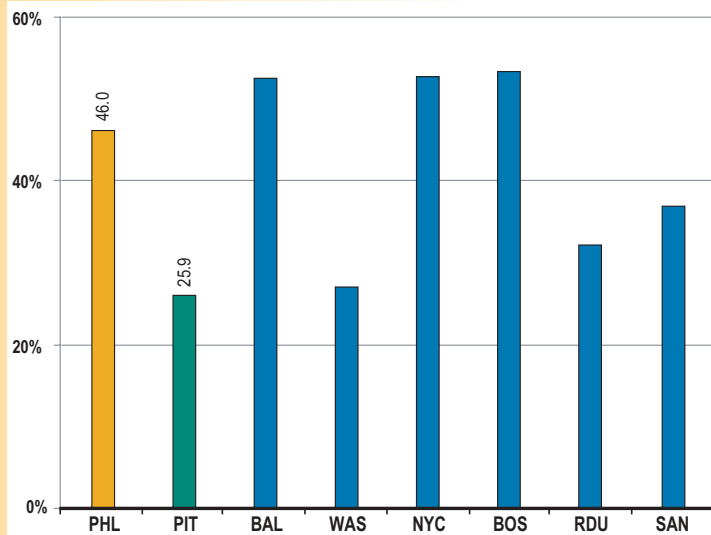
Number of International & Domestic Cities Served from Metropolitan Area Airports; Scheduled Flights July 2002



Sources: OAG Inc.

## Broadband Internet Availability

Percent of ZIP Codes in Metropolitan Area Served by Four or More Broadband Internet Providers



Source: Federal Communications Commission (FCC)

### What is this indicator?

As digital communication continues to expand, the ability to transfer large amounts of data over the Internet increases in importance for all kinds of businesses. The ability to move large volumes of data is determined by bandwidth availability — that is, the carrying capacity of the connection between sender and receiver.

This indicator measures the share of ZIP codes served by four or more cable, DSL and other broadband service providers in each metropolitan area, as of June 30, 2001. This measure provides an indication of the extent of the broadband market, as well as some (limited) measure of competition. It is a proxy for how wired a region is.

### Where does the Philadelphia region stand?

Philadelphia is wired to compete globally. At 46 percent, Philadelphia ranks fourth in the share of metropolitan area ZIP codes served by four or more broadband service providers. That puts it closer to the top three regions and well ahead of the four regions that lag behind.

The extent of Philadelphia's broadband digital infrastructure adds to the region's competitiveness in attracting, retaining and growing companies that are important to the Innovation Economy.

### RECOMMENDATIONS

Vital and critical infrastructure should be emphasized when the State and region are marketed. In order to attract, retain and grow firms in local strategic technology clusters, it is critical to monitor their needs and ensure that the private and public services they require are available.

**What is this indicator?**

Increasingly, the world is driven by greater and more sophisticated skills. A skilled workforce is an asset to a region's economy and adds to its competitiveness and the ability to attract, retain and grow new businesses, particularly those that are vital to the Innovation Economy. From the perspective of employees, the level of wages relative to other regions is a factor in regional attractiveness.

These indicators measure the total number of skilled information-technology (IT) scientists and engineers in the workforce, that number as a share of total workforce and the average hourly wage for those workers.

**Where does the Philadelphia region stand?**

Philadelphia ranks fourth in total skilled information-technology workers and fifth in the share of skilled information-technology employees in the regional workforce. The region ranked fourth in average hourly wages for skilled IT workers, close to the national average.

Philadelphia is closer to the regions that rank below it in skilled IT workers and the share of total workforce than it is to those ahead of it for those measures. That creates challenges when marketing the local region. It also creates difficulties for local companies that have skilled hiring requirements.

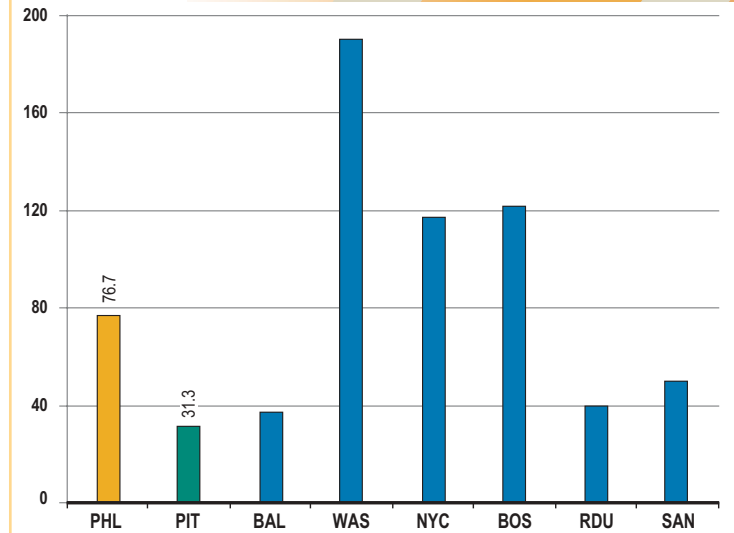
**RECOMMENDATIONS**

Collaborative efforts between industry, academia and the public sector to aggressively market the State's and region's concentration of skilled information technology workers must be made in order to attract, retain and grow businesses. Average hourly wages are at parity with the national average and slightly below the average for Boston, Washington metro and New York region is another asset for employers that needs to be stressed.

Attracting and retaining skilled information technology workers is another activity where private, public and academic organizations collaborate. The region's image must be enhanced and positive quality-of-life attributes must be aggressively marketed.

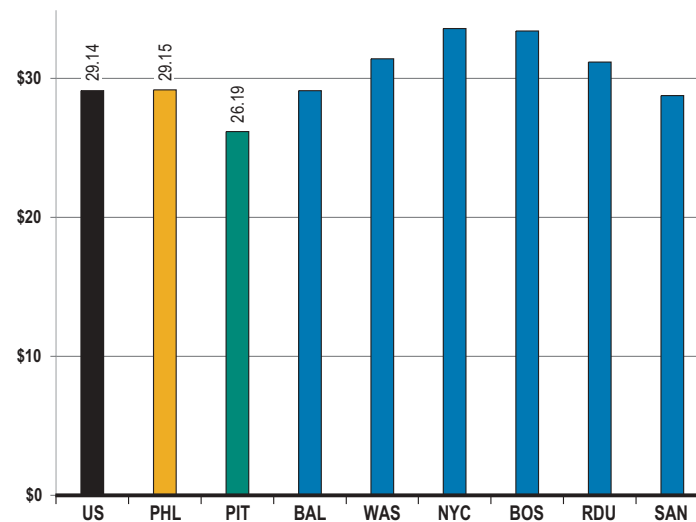
**Skilled Information Technology Workforce**

**Information Technology Scientists & Engineers in Workforce 2000**  
(in thousands)



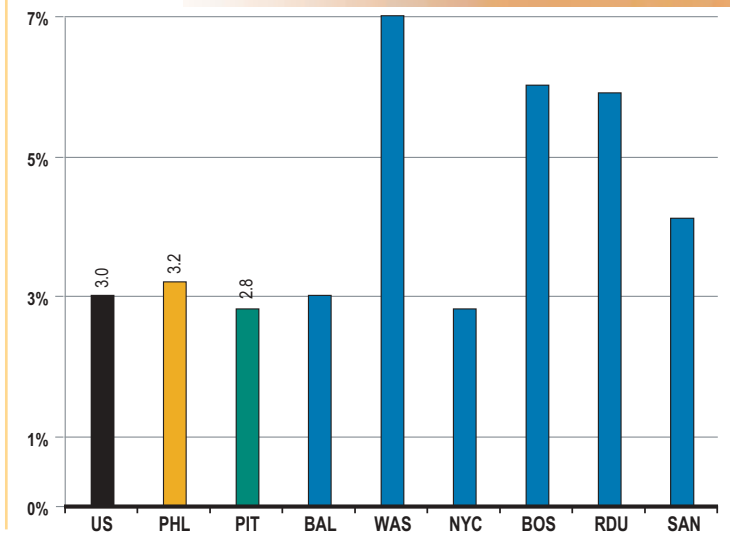
Source: U.S. Department of Labor, Carnegie Mellon

**Information Technology Scientists & Engineers: Average Hourly Wage, 2000**



Source: U.S. Department of Labor, Carnegie Mellon

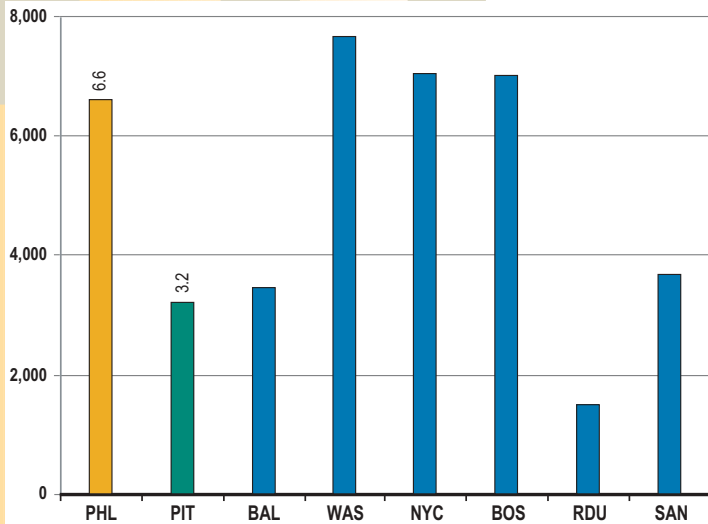
**Information Technology Scientists & Engineers: Share of Workforce, 2000**



Source: U.S. Department of Labor, Carnegie Mellon

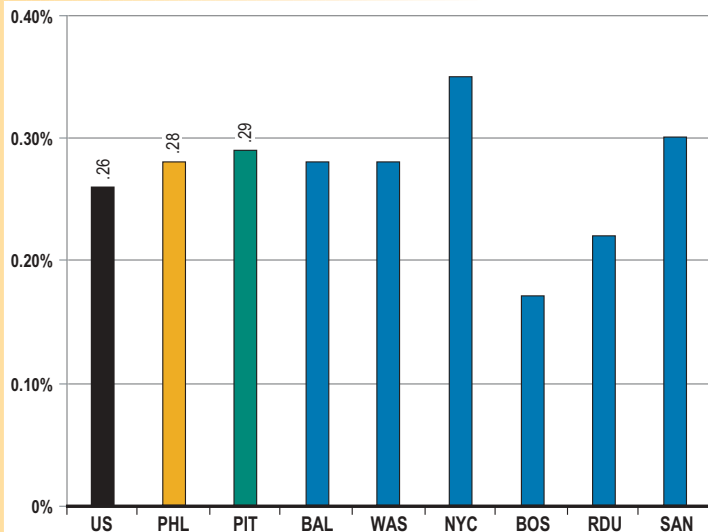
## Skilled Life Sciences/ Biotechnology Workforce

Life Sciences/Biotech Scientists & Engineers in Workforce, 2000



Source: U.S. Department of Labor, Career Development Resources of Texas

Life Sciences/Biotech Scientists & Engineers:  
Share of Workforce, 2000



Source: U.S. Department of Labor  
Career Development Resources of Texas

### What is this indicator?

As industrial technology accelerates, the need to address it through skilled labor grows correspondingly. The size of a region's skilled workforce creates competitive advantages and the ability to attract, retain and grow new businesses, especially those important to the Innovation Economy. From the perspective of employees, the level of wages relative to other regions is a factor in regional attractiveness.

These indicators measure the total number of skilled life science and biotech scientists and engineers in the workforce, that number as a share of total workforce and the average hourly wage for those employees.

### Where does the Philadelphia region stand?

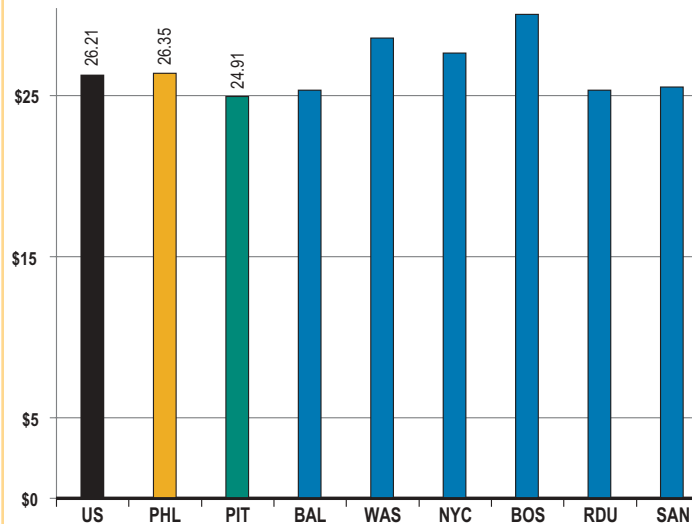
Philadelphia ranks fourth in total skilled life science and biotech workers and sixth in the share of those knowledge workers in the regional workforce. Philadelphia is close to the regions that rank above it in skilled life sciences and biotechnology workers and the share of total workforce. The region ranked fifth in average hourly wages for skilled life science and biotech workers, close to the national average.

### RECOMMENDATIONS

The relative concentration of skilled life science and biotechnology workers in the region creates opportunities when marketing the State and region to companies with skilled hiring requirements. The pool of knowledge workers needs to be marketed aggressively to attract, retain and grow businesses. Average hourly wages at parity with the national average and slightly below the average for Boston, Washington metro and New York, is another advantage for employers that should be stressed.

Given the volatility intrinsic to life sciences as job and company dynamics shift, it is important that Pennsylvania not yield its competitive advantages. Attracting and retaining skilled and semi-skilled (e.g. lab techs) workers is an activity that requires the collaboration of private, public and academic organizations. The Knowledge Industry Partnership is a broad coalition of Philadelphia institutions that are working to better connect the region's knowledge industry of colleges and universities to regional economic development activity.

Life Sciences/Biotech Scientists & Engineers:  
Average Hourly Wage, 2000



Source: U.S. Department of Labor  
Career Development Resources of Texas

**What is this indicator?**

The Brookings Institution recently completed a study that examined the potential for life sciences as a regional economic development driver at locations around the United States. The study concluded that the metropolitan areas at the forefront of life sciences are Boston, Los Angeles, New York, Philadelphia, Research Triangle Park, (NC), San Diego, San Francisco, Seattle and Washington/ Baltimore.

This indicator shows Philadelphia's performance in three areas relative to the other life sciences regions identified by Brookings: market capitalization of public biotechnology companies (2001), total venture capital investment in biopharmaceuticals (1995 to 2001) and total biotechnology patents (1990 to 1999).

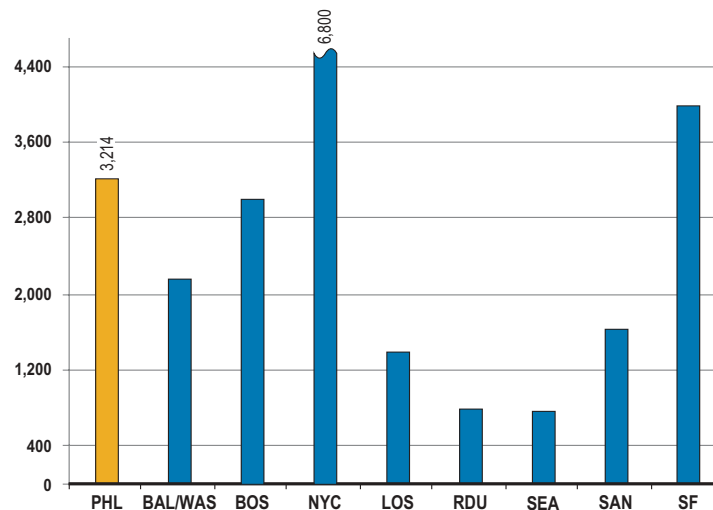
**Where does the Philadelphia region stand?**

While the region merited ranking by Brookings, several of the other regions identified outperformed Philadelphia. Philadelphia had the lowest market capitalization of public biotech firms in the group. Philadelphia ranked fifth based on total venture capital invested in biopharmaceuticals from 1995 through 2001 — \$500 million — while San Francisco, the leader, received more than three billion dollars in funding. Philadelphia ranked third in the group, based on the number of biotechnology patents issued during the past decade.

**RECOMMENDATIONS**

The Brookings Institution identified Philadelphia among the nation's biotechnology leaders. The region must become more aggressive to remain competitive in life sciences. Philadelphia's stature can be advanced and promoted through greater commitment of state funds and greater leverage against federal funds to commercialize technology, seed early ventures and start and build more life science companies in the region. While the Commonwealth recently committed a total of \$100 million for three Life Sciences Greenhouses across the state — part of the proceeds gained from the multi-state settlement with tobacco companies — many other states are aggressively investing larger and longer term, multi-year portions of their tobacco settlement funds to accelerate life science commercialization activity through venture funds, dedicated agencies and other transaction mechanisms.

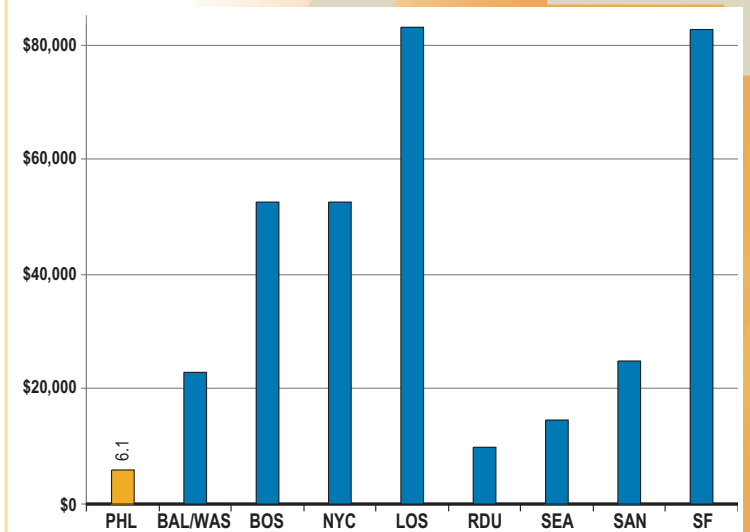
**Biotechnology Patents (1990 to 1999)**



Source: The Brookings Institution

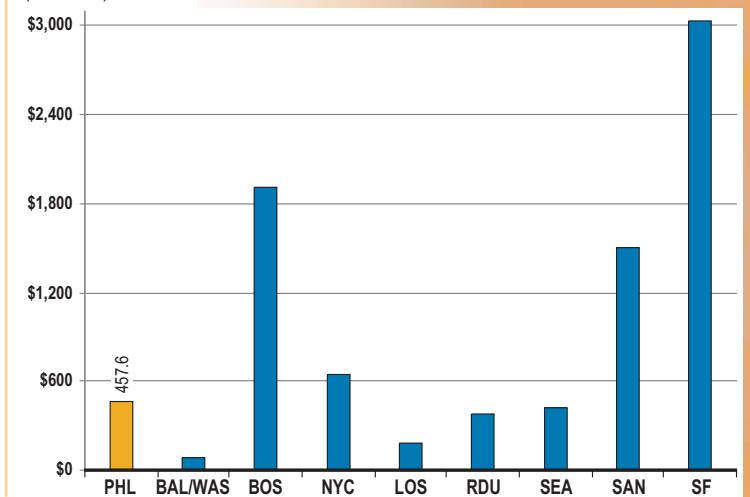
**Brookings Biotechnology Rankings**

**Market Capitalization of Local Biotech Companies in 2001 (\$ millions)**



Source: The Brookings Institution

**Total Venture Capital Investment in Biopharmaceuticals (1995 to 2001) (\$ millions)**



Source: The Brookings Institution

## Location Indicator 25

### Business Location Rankings

**Inc Magazine/Cognetics Business Location Ranking\***  
(out of 50 cities)      1999      2001

Raleigh/Durham, N.C.	4	3
Washington, D.C.	6	6
San Diego	17	16
Baltimore	27	27
Boston	36	31
Philadelphia	43	42
New York City	47	44
Pittsburgh	44	46

\* NOTE: Lower rank corresponds to a more favorable ranking

Source: Inc Magazine and Cognetics Inc.

**Forbes/Milken Institute Business Location Ranking\***  
(Out of 162 cities)      1999      2002

San Diego	12	1
Raleigh/Durham, N.C.	18	20
Washington, D.C.	21	28
Boston	29	45
Baltimore	137	81
Philadelphia	84	116
Pittsburgh	111	132
New York City	48	152

\* NOTE: Lower rank corresponds to a more favorable ranking

Source: Forbes Magazine and Milken Institute

#### What is this indicator?

Many factors enter into business decisions about where to locate initially and where to expand. Similarly, regions vary in the climate for success that they offer to entrepreneurs and emerging companies. The academic and popular business literature includes many studies that look at the relationship between business location and business success. Several studies create composite indexes that rate locations based on past economic performance.

*Forbes*, in conjunction with the Milken Institute, created a composite index that ranks 162 metropolitan areas based on employment and wage growth over one- and five-year periods, as well as a measure of local high technology activity. *Inc Magazine*, in conjunction with Cognetics Inc., created an index that ranks 50 metropolitan areas based on measures of firm and employment growth for young, small companies.

This indicator shows the rank in 1999 and 2001 for each metropolitan area as calculated for the *Forbes*/Milken Institute (out of 162 regions) and *Inc*/Cognetics reports (out of 50 regions). Both studies consider a lower rank more desirable, with the best location ranked first (out of 162 and 50, respectively).

#### Where does the Philadelphia region stand?

Both studies generally favor areas in the south and West over areas in the Northeast as better business locations. While there are exceptions to the generalization and regions change position in the rankings from year to year, it is clear that neither study favors Philadelphia.

#### RECOMMENDATIONS

The Commonwealth needs to aggressively refute its poor showing in business location rankings such as those produced by *Inc*/Cognetics and *Forbes*/Milken Institute. Positive marketing must be combined with the collaborative efforts of the private, public and academic sectors to reverse trends for parameters where Philadelphia scores poorly.

Innovation Philadelphia participates with other public and private entities to inform the public about Philadelphia's many assets for business and lifestyle.

“Science is intimately integrated with the whole social structure & cultural tradition.”

Talcott Parsons  
Sociologist

## New Business Starts

### What is this indicator?

New businesses are an essential ingredient of what the economist Joseph Schumpeter described as *Creative Destruction*, or the “essential fact about capitalism” (*Capitalism, Socialism and Democracy*; Harper: New York, 1975). For the local region to remain dynamic and to compete in the Innovation Economy, new-business starts are an essential ingredient. They embody innovation. Through the identification of new or overlooked opportunities and the application of new ideas, new businesses continuously refresh the economy, replacing old or declining businesses and creating new jobs. New businesses, which almost always begin under risky conditions, are also a gauge of a region’s entrepreneurial climate.

This indicator shows the number of new businesses started in each region in 2001, in aggregate and per 1,000 population.

### Where does the Philadelphia region stand?

Philadelphia ranked fourth in total number of new businesses created in 2001. The region ranked sixth in new business starts per 1,000 population, below the national average. Examining the data for each city by firm size, based on employment and revenue, shows no significant variation in the mix of starts for any of the locations.

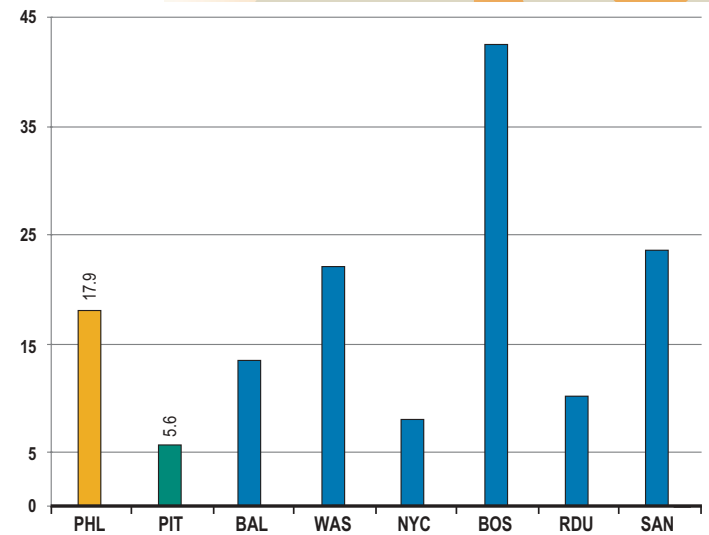
The relatively low number of business starts in the region is of concern. While many new businesses are small and neighborhood oriented (such as

restaurants and dry cleaners) and are closely linked to population trends, the low number of business starts can indicate challenges when it comes to replacing old, declining industry jobs with knowledge-based future-oriented companies and workers.

### RECOMMENDATIONS

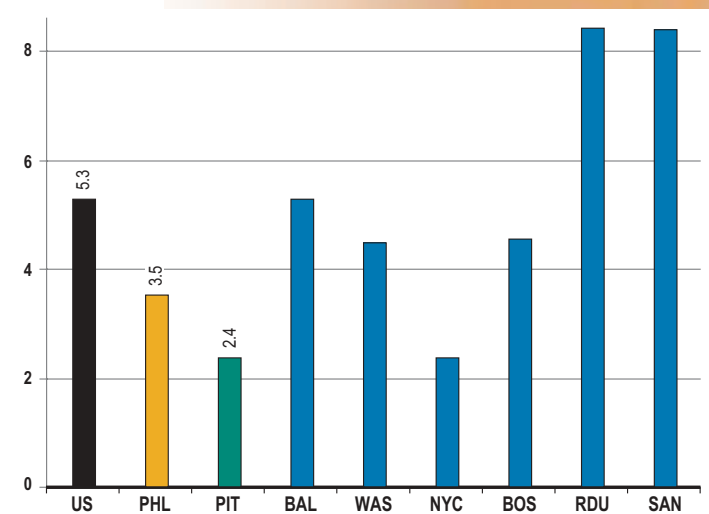
New business starts must be raised in the Commonwealth through the collaborative efforts of organizations in the private, public and academic sectors. The Philadelphia region requires a global positioning strategy with respect to the Innovation Economy. Once that is established, there needs to be an education process, within the area and beyond, to inform people about Philadelphia’s many competitive advantages.

New Business Starts in 2001 (in thousands)



Source: Info USA

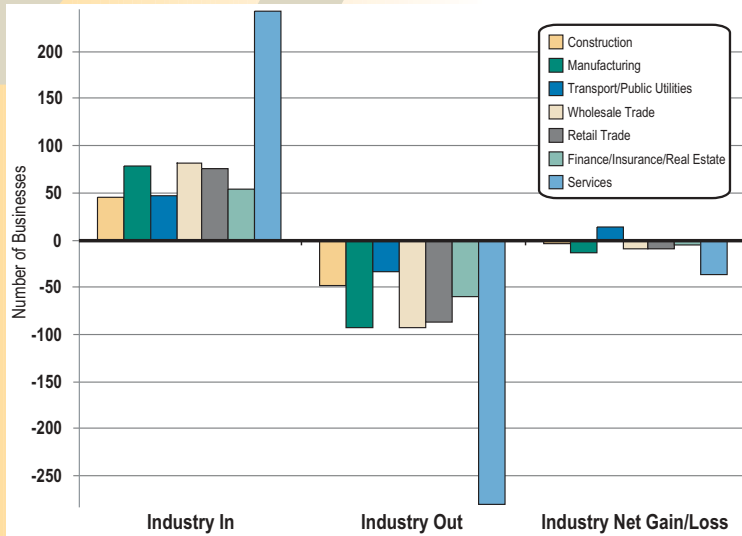
New Business Starts in 2001 per 1,000 Population



Source: Info USA

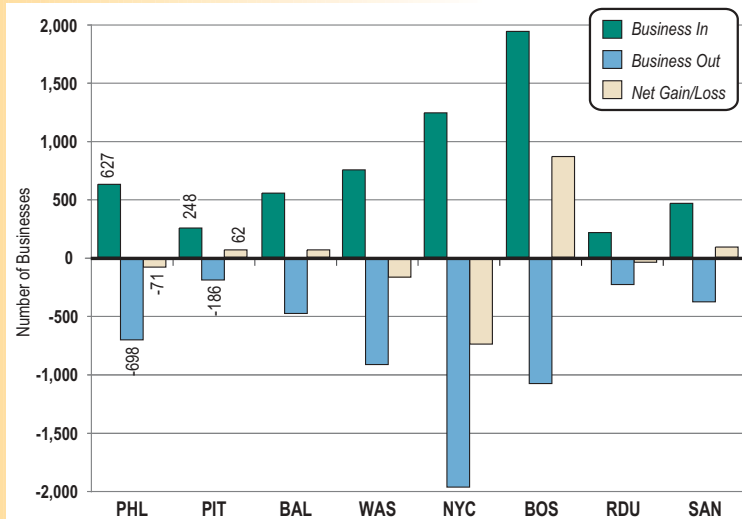
# Business Migration

Philadelphia PMSA Business Migration by Sector 1998 to 2001



Source: BizMiner

Metropolitan Area Business Migration 1998 to 2001



Source: BizMiner

## What is this indicator?

Business migration statistics provide a record of actual business decisions to move into or out of a region. They indicate the relative desirability of a region to those making business location decisions.

This indicator measures the number of businesses that moved in or out of each region from 1998 to 2001. Additional data by industry sector are reported for Philadelphia.

## Where does the Philadelphia region stand?

Philadelphia was one of four regions with more firms leaving (698 firms) than moving in (627 firms), although the net loss (71 firms) was relatively small. This has negative implications for Philadelphia as a place for businesses to locate. Based on either employment or revenues, there appear to be no differences in the mix of firms moving in or out of Philadelphia, as compared with the other benchmark regions.

A detailed look at business migration data by industry for Philadelphia shows that net out migration occurred in every sector but transportation and public utilities, where one would expect firm location to be relatively fixed.

While net migration out of Philadelphia from 1998 to 2001 is small given the total size of the region, the net loss of firms is troubling — however, it should be possible to envision and orchestrate a turnaround — that is, net positive business migration — as a result of improving desirability.

**RECOMMENDATIONS**

Net negative migration contributes to image problems for the region. As the data indicates, out migration was 111 percent of in migration from 1998 to 2001. Details of the imbalance should be examined, and a concerted collaborative effort by the public, private and academic sectors should be made to reverse the trend by addressing specific issues — such as costs of doing business and quality-of-life — where they are identified. In addition, an aggressive campaign to change the region's image and promote Philadelphia as a quality place to work and live needs to be conducted.

# Gazelle Firms Employment

## What is this indicator?

Numerous studies have demonstrated that young firms with high rates of employment growth account for the majority of new jobs created in the United States — by some estimates as many as two-thirds to three-quarters of net new jobs. A region with a high proportion of such firms and jobs is indicative of a dynamic local economy. Gazelle firms are defined as companies with an initial sales base of at least \$100,000 that grow at least 20 percent per year over a continuous four-year period.

This indicator measures the number of workers employed by gazelle firms in 1997 and 2000, as well as the share of total regional employment that gazelle firms constitute.

## Where does the Philadelphia region stand?

Philadelphia ranked third in total employment by gazelle firms in 1997 and 2000. At the beginning of the period, Philadelphia ranked fourth in the share of total workers employed by gazelles, falling to fifth place by the end of the period. In both years, the local share of total employment by gazelles was slightly below the average for the 50 largest metropolitan areas. That reflects the composition of Philadelphia's employment mix, with older, larger firms accounting for the largest share of total employment.

There is nothing wrong with a large employment base inside mature firms, however the more entrepreneurial components of the Innovation Economy rely on gazelles and other small, rapidly growing businesses for innovation and

ideas as well as employment growth. In the United States, small business represents more than 99 percent of all employers and accounts for more than half of all private sector employees and output.

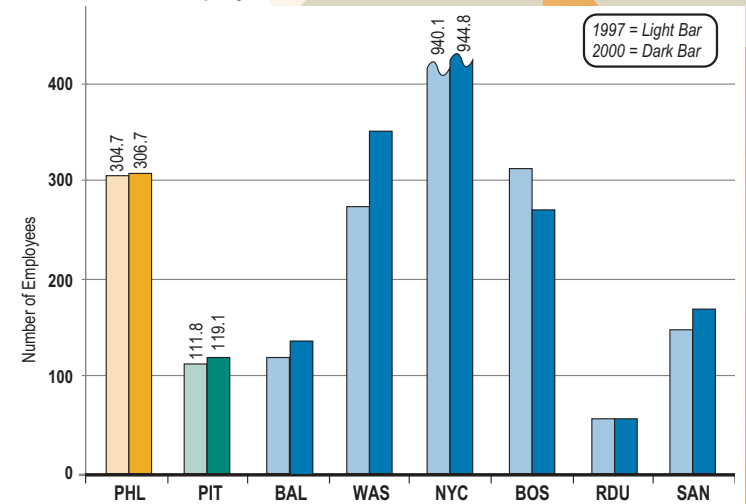


### RECOMMENDATIONS

Philadelphia's competitive advantages, which result in a strong concentration of gazelles, should be aggressively marketed to attract other new companies and knowledge workers.

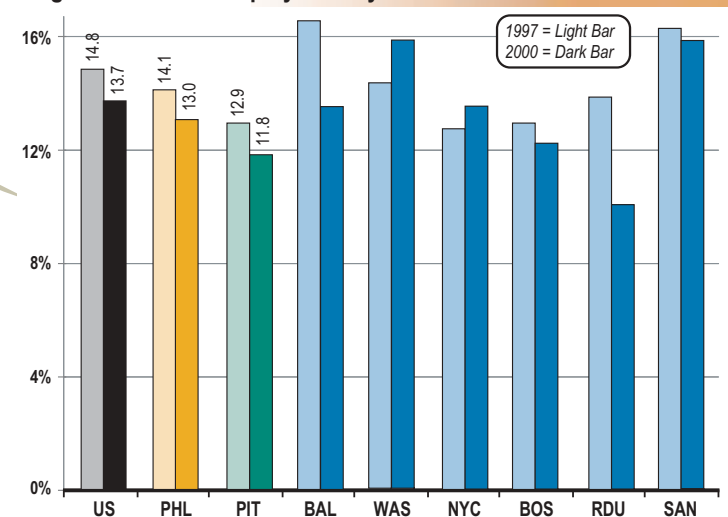
A concerted effort should be made to increase local gazelle firm activity through the provision of superior small-business assistance in the region. That requires the collaboration and participation of many organizations from the private, public and academic sectors.

Gazelle Firms Employment (in thousands)



Source: Cognetics Inc.

Regional Share of Employment by Gazelle Firms



Source: Cognetics Inc.

# Creative Class Ranking

**Overall Creative Class Ranking in U.S.\***  
(out of 268 regions)

	Overall Rank <small>(1 million+ population)</small>	Creative Class	High Tech	Innovation	Diversity
San Diego	3	6	2	12	41
Boston	4	30	14	13	4
Raleigh-Durham, N.C.	6	5	16	8	52
Washington-Baltimore	8	4	5	85	18
New York City	9	25	15	54	20
Philadelphia	17	27	17	36	70
Pittsburgh	36	53	31	50	210

\* NOTE: Lower rank corresponds to a more favorable ranking  
Source: The Rise of the Creative Class, Richard Florida, 2002

“Creativity has come to be valued – and systems have evolved to encourage and harness it – because new technologies, new industries, new wealth and all other good economic things flow from it.”

**Dr. Richard Florida**  
H. John Heinz III Professor  
Carnegie Mellon University

**What is this indicator?**

Just as the economy has undergone past transitions from agriculture to heavy industry to knowledge, so that progression continues. Dr. Richard Florida, H. John Heinz III Professor of Regional Economic Development, Carnegie Mellon University, has identified creativity as a key strength that underlies the transition and increasingly contributes to economic development. By Florida’s analysis, the so-called Creative Class includes nearly 38 million Americans in many diverse fields, representing more than 30 percent of the workforce. Regions that are rich with Creative Class workers and that provide the attributes to attract and retain such people hold a competitive advantage in the Innovation Economy.

This indicator shows the composite rank for each metropolitan area as calculated by Dr. Florida based on their rank in four categories of inputs: Creative Class, High Tech, Innovation and Diversity. A lower rank is more desirable, with the best location ranked first. Rankings are based on 268 regions for which data are available.

**Where does the Philadelphia region stand?**

Philadelphia ranked 19th overall (and 17th out of 49 regions with population over one million). By Florida’s definition, almost one-third of the local employment base in the Philadelphia region (927,000 out of 2,879,000 jobs) belongs to the Creative Class. Six of the eight regions compared within this study ranked in the top 10 (out of 268 regions overall and 49 regions with population over one million). Only Pittsburgh (57th overall and 36th out of regions with population over one million) ranked lower than Philadelphia.

Although Philadelphia ranks in the top 20 nationally, it lags other regions that are generally regarded as leaders in the Innovation Economy race.

**RECOMMENDATIONS**

Philadelphia’s and Pittsburgh’s ranks against other benchmark regions should be improved through concerted collaborative efforts by public, private and academic elements to improve performance on parameters that go into the rankings. Efforts in which Innovation Philadelphia participates, such as the Knowledge Industry Partnership — to change the local “brain drain” to “brain gain” and create a world-class life long learning environment and diverse workforce — and “Positively Philadelphia” — a collaborative marketing consortium — are working to improve the region’s rank.

## Metropolitan Area (MA) Overview & Definitions

### *The Metropolitan Area (MA) Program, MAs and MSAs: Regional Building Blocks*

The Federal government's Metropolitan Area (MA) program has been in existence since the 1950 decennial Census, to ensure the quality and consistency of statistical data produced by Federal agencies. The concept underlying Metropolitan Areas is that of a core area containing a large population concentration along with adjacent communities that have a high degree of economic and social integration to the core. In general, entire counties form the MA building blocks, except in New England, where cities and towns are the basic geographic units. The current definitional standards were published in the Federal Register on December 27, 2000, by the Office of Management and Budget (OMB), in accordance with the results of the 2000 decennial census.

By 1990, OMB standards defined an area as a Metropolitan Statistical Area (MSA) in one of two ways:

1. If it included a city of at least 50,000 population, OR
2. If it included a Census Bureau-defined urbanized area (of at least 50,000 population) with a total metropolitan population of at least 100,000 (75,000 in New England).

An MSA may include additional counties that have strong economic and social ties to the central county or counties containing the main city or urbanized area. The ties are determined chiefly by census data on commuting to work. MSAs may contain more than one city of 50,000 population and may cross state lines.

### *CMSAs and PMSAs: Where We Fit In*

An area that meets the requirements for recognition as an MSA but also has a total population of one million or more may be recognized as a Consolidated Metropolitan Statistical Area (CMSA) if:

1. Separate component areas can be identified within the entire area that meet specified statistical criteria as an MA (i.e., central urban core, economic and social integration), AND
2. Local opinion indicates there is support for the separate component areas.

If recognized, the separate component areas are designated Primary Metropolitan Statistical Areas (PMSA), and the entire area becomes a CMSA. CMSAs, by definition, always have one million population or more. However, if no PMSAs are recognized, the entire area is designated an MSA. Another way to think of CMSAs is as contiguous or linked MSAs.

MAs are titled using the names of their largest, central cities, which are designated under the standards for each MA and CMSA. Up to three city names may appear in a title. Titles of most PMSAs also are based on central city names, but in certain cases consist of county names. Titles of CMSAs generally are based on the names of the MAs or CMSAs to which they pertain.

Thus, the Philadelphia, Pennsylvania-New Jersey PMSA, as it is officially designated, is part of the Philadelphia-Wilmington-Atlantic City CMSA, which includes counties in Pennsylvania, New Jersey, Delaware and Maryland. The larger CMSA regional designation holds because:

1. The entire region has population greater than one million, AND
2. There are multiple separate and identifiable urban cores, all tied together as part of a larger economic entity, based on census data on commuting to work.

The Philadelphia, Pennsylvania-New Jersey PMSA, which corresponds to the region described throughout this publication, is designated as a PMSA because it represents one of the urban cores — Philadelphia County — and the surrounding, economic and socially integrated counties in the larger CMSA.

### *MAs Compared in this Publication*

The Metropolitan Areas considered in this publication, including their component counties (and other geographic areas, where indicated—primarily New England), are listed below. Abbreviations are listed in parentheses:

#### **Philadelphia, PA-NJ PMSA (PHL):**

Burlington County, NJ  
Camden County, NJ  
Gloucester County, NJ  
Salem County, NJ  
Bucks County, PA  
Chester County, PA  
Delaware County, PA  
Montgomery County, PA  
Philadelphia County, PA

#### **Pittsburgh, PA MSA (PIT):**

Allegheny County, PA  
Beaver County, PA  
Butler County, PA  
Fayette County, PA  
Washington County, PA  
Westmoreland County, PA

#### **Baltimore, MD PMSA (BAL):**

Anne Arundel County, MD  
Baltimore County, MD  
Carroll County, MD  
Harford County, MD  
Howard, Maryland  
Queen Annes County, MD  
Baltimore (independent city), MD

#### **Washington, DC-MD-VA-WV PMSA (WAS):**

District of Columbia  
Calvert County, MD  
Charles County, MD  
Frederick County, MD  
Montgomery County, MD  
Prince Georges County, MD  
Arlington County, VA  
Clarke County, VA  
Culpeper County, VA  
Fairfax County, VA  
Fauquier County, VA  
King George County, VA  
Loudoun County, VA  
Prince William County, VA  
Spotsylvania County, VA  
Stafford County, VA  
Warren County, VA  
Alexandria city, VA  
Fairfax (city), VA  
Falls Church (city), VA  
Fredericksburg (city), VA  
Manassas (city), VA  
Manassas Park (city), VA  
Berkeley County, WV  
Jefferson County, WV

#### **New York, NY PMSA (NYC):**

Bronx County, NY  
Kings County, NY  
New York County, NY  
Putnam County, NY  
Queens, NY  
Richmond County, NY  
Rockland County, NY  
Westchester County, NY

## Appendix A

### **Boston, MA-NH PMSA (BOS):**

Bristol County, MA (part):  
Berkley (town)  
Dighton (town)  
Mansfield (town)  
Norton (town)  
Taunton (city)  
Essex County, MA (part):  
Amesbury (town)  
Beverly (city)  
Danvers (town)  
Essex (town)  
Gloucester (city)  
Hamilton (town)  
Ipswich (town)  
Lynn (city)  
Lynnfield (town)  
Manchester-by-the-Sea (town)  
Marblehead (town)  
Middleton (town)  
Nahant (town)  
Newbury (town)  
Newburyport (city)  
Peabody (city)  
Rockport (town)  
Rowley (town)  
Salem (city)  
Salisbury (town)  
Saugus (town)  
Swampscott (town)  
Topsfield (town)  
Wenham (town)  
Middlesex County, MA (part):  
Acton (town)  
Arlington (town)  
Ashland (town)  
Ayer (town)  
Bedford (town)  
Belmont (town)  
Boxborough (town)  
Burlington (town)  
Cambridge (city)  
Carlisle (town)  
Concord (town)  
Everett (city)

Framingham (town)  
Holliston (town)  
Hopkinton (town)  
Hudson (town)  
Lexington (town)  
Lincoln (town)  
Littleton (town)  
Malden (city)  
Marlborough (city)  
Maynard (town)  
Medford (city)  
Melrose (city)  
Natick (town)  
Newton (city)  
North Reading (town)  
Reading (town)  
Sherborn (town)  
Shirley (town)  
Somerville (city)  
Stoneham (town)  
Stow (town)  
Sudbury (town)  
Townsend (town)  
Wakefield (town)  
Waltham (city)  
Watertown (city)  
Wayland (town)  
Weston (town)  
Wilmington (town)  
Winchester (town)  
Woburn (city)  
Norfolk County, MA (part):  
Bellingham (town)  
Braintree (town)  
Brookline (town)  
Canton (town)  
Cohasset (town)|  
Dedham (town)  
Dover (town)  
Foxborough (town)  
Franklin (city)  
Holbrook (town)  
Medfield (town)  
Medway (town)  
Millis (town)

Milton (town)  
Needham (town)  
Norfolk (town)  
Norwood (town)  
Plainville (town)  
Quincy (city)  
Randolph (town)  
Sharon (town)  
Stoughton (town)  
Walpole (town)  
Wellesley (town)  
Westwood (town)  
Weymouth (town)  
Wrentham (town)  
Plymouth County, MA (part):  
Carver (town)  
Duxbury (town)  
Hanover (town)  
Hingham (town)  
Hull (town)  
Kingston (town)  
Marshfield (town)  
Norwell (town)  
Pembroke (town)  
Plymouth (town)  
Rockland (town)  
Scituate (town)  
Wareham (town)  
Suffolk County, MA (part):  
Boston (city)  
Chelsea (city)  
Revere (city)  
Winthrop (town)  
Worcester County, MA (part):  
Berlin (town)  
Blackstone (town)  
Bolton (town)  
Dedham (town)  
Hopedale (town)  
Lancaster (town)  
Mendon (town)  
Milford (town)  
Millville (town)  
Southborough (town)  
Upton (town)

Rockingham County, NH (part):  
Seabrook (town)  
South Hampton (town)

### **Raleigh-Durham-Chapel Hill, NC (MSA):**

Chatham County, NC  
Durham County, NC  
Franklin County, NC  
Johnston County, NC  
Orange County, NC  
Wake County, NC

### **San Diego, CA MSA (SAN):**

San Diego County, CA

## Data Sources

**Indicator 1: Federal Investment in University Science and Engineering Research; and**

**Indicator 2: State & Local Investment in University Science and Engineering Research; and**

**Indicator 3: Industry & Other Support in University Science and Engineering Research; and**

**Indicator 4: Academic Investment in University Science and Engineering Research**

*Source: National Science Foundation (NSF)*

Footnote: Information for academic years ending 1995 to 2000 was downloaded from the National Science Foundation's (NSF) WebCASPAR web site (<http://caspar.nsf.gov>.) The information is consistent with that contained in the NSF publication *Academic Research and Development Expenditures: Fiscal Year 2000*. Academic institutions were assigned to metropolitan areas based on their ZIP codes.

**Indicator 5: Size of College and University Endowments**

*Sources: Endowments: National Association of College and University Business Officers. Enrollment: US Department of Education*

Footnote: The source of the endowment information is the National Association of College and University Business Officers (NACUBO) annual Endowment Studies. This information is published by the Chronicle of Higher Education. Information was downloaded from the Chronicle's website for the period spanning the academic years 1995-1996 through 2000-2001 as six separate tables, one for each academic year. The NACUBO data has information for a total of 678 universities over this six year period. However, only 365 institutions reported endowment information for all 6 of these academic years. To make the sample as inclusive as possible, we included only the 424 institutions that reported endowment information in the two academic years 1995-1996 and 2000-2001. 77 of these were in one of the eight (P)MSAs in this study. Endowment value for universities with multiple campuses was allocated among the campuses based on enrollment.

Academic institutions were assigned to metropolitan areas based on their ZIP code. We have normalized this information using the enrollment for the institutions reporting endowments. In general, enrollment information was for 1997 and is taken from the Higher Education General Information Survey and the Integrated Postsecondary

Education Data System which is conducted by the Department of Education's National Center for Education Statistics.

**Indicator 6: Science & Engineering Degrees Awarded**

*Sources: Degrees: National Science Foundation (NSF); Population: U.S. Census Bureau*

Footnote: Information is from the NSF WebCASPAR web site and covers doctorate, first professional, master's, and bachelor's degrees. The source of this data is the Higher Education General Information Survey and the Integrated Post-Secondary Education Data System, which is conducted by the Department of Education's National Center for Education Statistics. Academic institutions were assigned to metropolitan areas based on their ZIP codes.

**Indicator 7: Invention Disclosures & Patents Filed by Research Institutions**

*Source: Association of University Technology Managers Inc. (AUTM)*

Footnote: This indicator measures the adjusted license income as reported by the Association of University Technology Managers Inc. (AUTM). Data covers fiscal years 1995 to 2000 and includes U.S. universities as well as U.S. hospitals and research institutes. Adjusted license income is calculated by AUTM for 1996 to 2000 by subtracting license income paid to other institutions from gross license income received. The 1995 information was reported as gross royalties received and royalties paid to other institutions, and adjusted license income had to be calculated separately. Note: AUTM changed from using the term "royalties" to using "license income" from 1995 to 1996, but the terms are interchangeable. Note that the AUTM data does not include all universities. For example, in 2000, the AUTM data includes information from 168 U.S. universities, hospitals, and research institutes.

**Indicator 8: Patent Productivity**

*Sources: Patent number and impact: CHI Research Inc. Number of Scientists and Engineers: U.S. Department of Labor.*

Footnote: This indicator measures the total number of patents and the impact index for each of the eight metropolitan areas for 1992 to 2001. Information was purchased from CHI Research, Inc.

The number of patents is a count of Type 1 (regular, utility) patents issued in the U.S. patent system. Assignment to an MSA or PMSA is based on the residence of the inventor. Note that a patent will be included in the patent count for all (P)MSAs

represented by inventors. Thus, in those cases where multiple inventors are not all from the same (P)MSA, the same patent may be counted in more than one (P)MSA (<http://www.chiresearch.com/about/data/tech/tlbp4.php3> for more detail.)

To derive the relative productivity of researchers in each metropolitan area, we divided the total number of patents by the number of scientists and engineers present in the workforce. To arrive at the number of scientists and engineers present in the workforce, we used information from the Occupational Employment Statistics (OES) Survey, produced by the Bureau of Labor Statistics, U.S. Department of Labor. The OES Survey provides information on the employment in each of the metropolitan area for 611 occupations. We selected from these occupations those 47 occupations that met the following criteria:

- 1) The occupation is included on a list of “high-tech” occupations in the May 2001 issue of INCONTEXT, published jointly by the Indiana Business Research Center at Indiana University’s Kelly School of Business, the Indiana Department of Commerce, and the Indiana Department of Workforce Development.
- 2) The occupation is assigned to a training/education category of bachelors degree or above by the U.S. Bureau of Labor Statistics Office of Occupational Statistics and Employment Projections.

Note that information on the number of patents is provided for the Boston NECMA not the Boston PMSA. Information on workforce is available at the Boston PMSA level and not at the NECMA level (nor is it available at the county level, which would allow us to assemble the NECMA.) To account for this difference, we adjusted the number of scientists and engineers proportionally with the difference in total population between NECMA and the PMSA. This adjustment assumes that the concentration of scientists and engineers in the NECMA workforce is the same as in the PMSA workforce.

### Indicator 9: Royalty & Licensing Income to Universities; and

### Indicator 10: Start-ups Formed from University Research

Source: *Association of University Technology Managers Inc. (AUTM)*

Footnote: This indicator measures the adjusted license income as reported by the Association of University Technology Managers Inc. (AUTM). Data covers fiscal years 1995 to 2000 and includes U.S. universities as well as U.S. hospitals and research institutes. Adjusted license income is calculated by AUTM for 1996 to 2000 by subtracting license income paid to other institutions from gross license income received. The 1995

information was reported as gross royalties received and royalties paid to other institutions, and adjusted license income had to be calculated separately. Note: AUTM changed from using the term “royalties” to using “license income” from 1995 to 1996, but the terms are interchangeable. Note that the AUTM data does not include all universities. For example, in 2000, the AUTM data includes information from 168 U.S. universities, hospitals, and research institutes.

### Indicator 11: SBIR & STTR Awards

Sources: *U.S. Small Business Administration*

Footnote: Information was provided by the U.S. Small Business Administration as a listing of approximately 11,000 separate awards made in the ten states plus the District of Columbia in which part or all of the eight regions lie. Awards were assigned to metropolitan areas based on the ZIP code of the awardee.

To arrive at the number of scientists and engineers present in the workforce, we used information from the Occupational Employment Statistics (OES) Survey, produced by the Bureau of Labor Statistics, U.S. Department of Labor. The OES Survey provides information on the employment in each of the metropolitan area for 611 occupations. We selected from these occupations those 47 occupations that met the following criteria:

- 1) The occupation is included on a list of “high-tech” occupations in the May 2001 issue of INCONTEXT, published jointly by the Indiana Business Research Center at Indiana University’s Kelly School of Business, the Indiana Department of Commerce, and the Indiana Department of Workforce Development.
- 2) The occupation is assigned to a training/education category of bachelors degree or above by the U.S. Bureau of Labor Statistics Office of Occupational Statistics and Employment Projections.

### Indicator 12: NIH SBIR & STTR Proposals & Awards

Source: *National Institutes of Health (NIH)*

Footnote: The National Institutes of Health provided information as a listing of approximately 5,550 funded and 9,500 unfunded proposals made in the ten states plus the District of Columbia in which part or all of the eight regions lie. To protect confidentiality, only the ZIP code of the proposing organization was provided. Awards were assigned to metropolitan areas based on the ZIP code of the awardee.

**Indicator 13: ATP Proposals and Awards**

Source: *National Institute of Standards and Technology (NIST)*

Footnote: Information was provided by the National Institute of Standards and Technology as a listing of approximately 1,600 proposals made in the ten states plus the District of Columbia in which part or all of the eight regions lie. To protect confidentiality, only the ZIP code of the proposing organization was provided. Awards were assigned to metropolitan areas based on the ZIP code of the awardee.

**Indicator 14: Early Stage Venture Capital Investments; and****Indicator 15: Medical/Health/Life Sciences Venture Capital Investments****Indicator 16: Information Technology Venture Capital Investments**

Source: *Venture Economics*

Footnote: Information was provided by Venture Economics, a division of Thomson Financial ([www.tfn.com](http://www.tfn.com)).

**Indicator 17: Publicly Traded Companies**

Source: *FIS Online* ([www.fisonline.com](http://www.fisonline.com))

Footnote: The information is from FIS online (<http://www.fisonline.com/>). In order to be included, companies must be incorporated in the United States and have at least \$100,000 in assets.

**Indicator 18: Initial Public Offerings**

Source: *Alert-IPO! online* ([www.alert-ipo.com](http://www.alert-ipo.com))

Footnote: The data covers 1996 to 2001 and was obtained from Alert-IP! online. In order to be included in the data for a particular year, the IPO's must have been filed between January 1st to December 1st of the specified year. The IPOs could have been priced anywhere from January 1, 1996, to December 1, 2002.

**Indicator 19: Transport Time to D.C. & NYC**

Sources: *OAG, Inc; Amtrak*

Footnote: Total time consists of time to airport/train station, time before departure, flight/train duration, and time from airport/train station. Flight information was obtained from OAG by adding flight durations and travel time from airport to city center. Train

information was obtained from Amtrak by averaging train durations and using the quickest type of train (i.e., Acela Express). We assumed arrival 60 minutes before actual departure for airports, and ten minutes for train. Transit time to train station was estimated as 15 minutes for all cities.

**Indicator 20: Non-Stop Destinations Served**

Source: *OAG, Inc.*

Footnote: Raw information was purchased from OAG Inc. Each metropolitan area is served by one major airport, with the exceptions of Washington, D.C. and New York City, which are each served by three airports. Dulles (IAD), Reagan (DCA), and Baltimore-Washington (BWI) serve Washington, D.C. New York is served by Newark (EWR), LaGuardia (LGA), and Kennedy (JFK.) If more than one airport in a metropolitan area serves the same destination, that destination is counted only once. Similarly, if multiple airports at a given destination are served, that destination is counted only once (e.g., Chicago, with both Midway and O'Hare.)

**Indicator 21: Broadband Internet Availability**

Source: *Federal Communications Commission (FCC)*

Footnote: This indicator measures the number of ZIP codes with four or more holding companies in each of the eight metropolitan areas. Information is from the FCC's Form 477. Holding companies must provide high-speed service to at least one customer as of June 30, 2001, in order to be included in the data.

**Indicator 22: Skilled Information Technology Workforce; and****Indicator 23: Skilled Life Sciences/Biotechnology Workforce**

Sources: *U.S. Department of Labor, Carnegie Mellon, Career Development Resources of Texas*

Footnote: This indicator measures the number of scientists and engineers in the information-technology workforce. Information on workforce was downloaded for fiscal years 1997 to 2000 from the Bureau of Labor Statistics' Occupational Employment Statistics Survey. The information included the number of people employed in 733 different occupations for 1999 to 2000. A new set of occupational categories was introduced after the 1997 to 1998 information was released. Due to this change in occupation classifications, it was not possible to produce reliable trend information. Thus we report only the most recent year.

These data are not strictly comparable across metropolitan areas, since data for some occupational categories are suppressed for particular metropolitan areas because there are so few persons in those occupations or because a single firm employs a large portion of such persons.

The definition of occupations included in the information-technology workforce was developed by the Carnegie Mellon Center for Economic Development (1999 SOC IT Cluster Definition from An Action Plan for the Information Technology Cluster in Southwestern Pennsylvania, Prepared for the Pittsburgh Technology Council, December 2001 by the Carnegie Mellon Center for Economic Development). The definition of occupations included in the life sciences/biotech workforce was developed by Career Development Resources of Texas (formerly the State Occupational Information Coordinating Committee [SOICC]). See <http://www.cdr.state.tx.us/emerging/b-tech.html>.

### Indicator 24: Brookings Biotechnology Ranking

Source: *The Brookings Institution*

Footnote: All data is from the *Biomedical Research & Biotechnology Commercialization Report*, published June 2002.

### Indicator 25: Business Location Rankings

Source: *Forbes and Inc Magazines*

Footnote: The Milken Institute prepares the Forbes ranking; the Inc rankings are prepared by Cognetics Inc. The Milken rankings for fiscal years 1999 to 2002 were obtained from The Forbes/Milken list of Best Places for Business and Careers. 2000 to 2002 rankings included the top 200 metropolitan areas, and 1999 included 162 metropolitan areas. The overall ranking is based on the latest government data for employment and wage growth over one- and five-year periods. The Milken Institute collected the information that Forbes and Milken used to establish these rankings from official sources.

The Inc Magazine (Cognetics) rankings are from fiscal years 1996-2001 and were obtained from their yearly publications entitled, *Entrepreneurial Hot Spots: The Best Places in America to Start and Grow a Company*. Rankings are based on a weighted index of the number of firms started in the last ten years that employ at least five people today, as a percent of all firms, and the percent of firms ten years old or less four years ago that had a Growth Index (a measure of percent and absolute growth) of at least three over the past four years.

The Forbes-Milken rankings were dated based on release year; the Inc-Cognetics rankings were dated based on the data year. We used the data year in presenting the rankings.

### Indicator 26: New Business Starts

Source: *Info USA*

Footnote: Information was provided by the research department of Info USA ([www.infousa.com](http://www.infousa.com)), a provider of sales and marketing information to businesses.

### Indicator 27: Business Migration

Source: *BizMiner* ([www.bizminer.com](http://www.bizminer.com))

Footnote: This information was provided BizMiner ([www.bizminer.com](http://www.bizminer.com).)

### Indicator 28: Gazelle Firms Employment

Source: *Cognetics* ([www.cogonline.com](http://www.cogonline.com))

Footnote: This information is from Cognetics' Corporate Almanac.

### Indicator 29: Creative Class Ranking

Source: *The Rise of the Creative Class*, Richard Florida

Footnote: The information is found in *The Rise of the Creative Class* published by Basic Books, 2002.

“All things [being equal],  
I'd rather be in Philadelphia.”  
W.C. Fields  
Humorist

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Vice President of Marketing and Communications ..... Richard A. Miller  
Managing Director and Vice President, Investments ..... Christopher Starr  
Director, Community and Economic Development ..... Kelly Lee  
Manager of Technology Innovation ..... Bart Mroz  
Executive Assistant ..... Ann Ivory  
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