

# FUTURES – 2050

## Innovation

Ram Mudambi

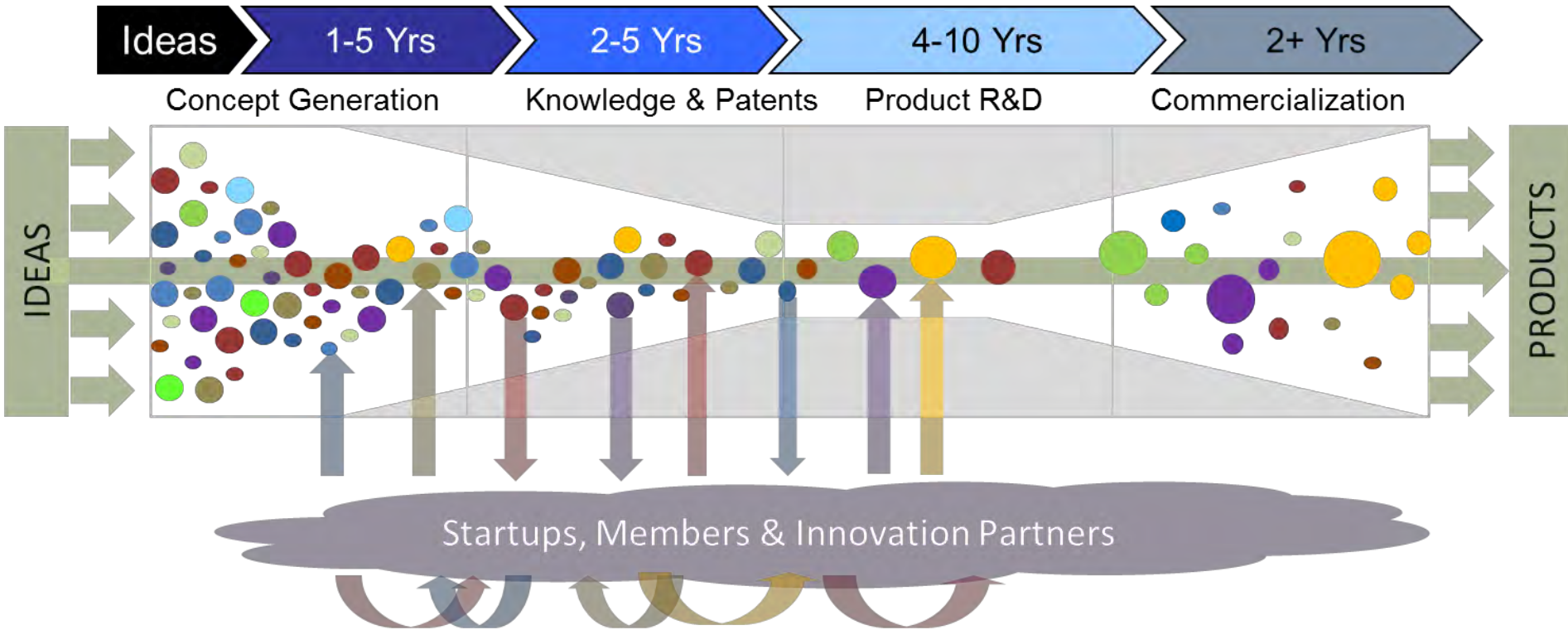
Frank M. Speakman Professor of Strategy

Fox School of Business

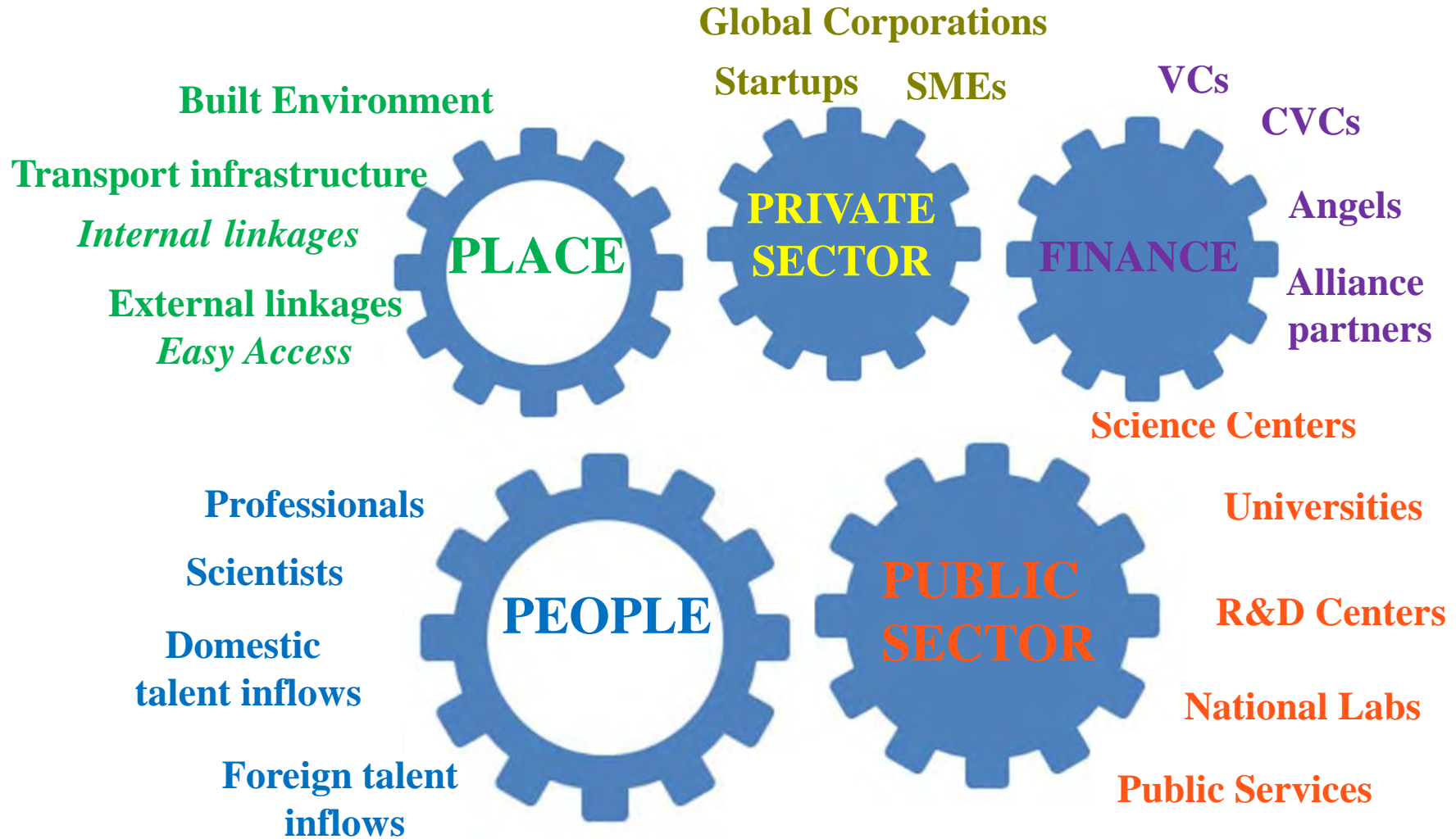
# Outline

- Components of city innovation systems
  - The key role of research institutions
- Philadelphia's innovation systems – leading sectors
- Philadelphia inventor location
  - The key role of rail transportation infrastructure
- Philadelphia inventor connectivity
  - core-periphery connectivity
  - global connectivity

# Innovation – turning ideas into products



# Innovation eco-system

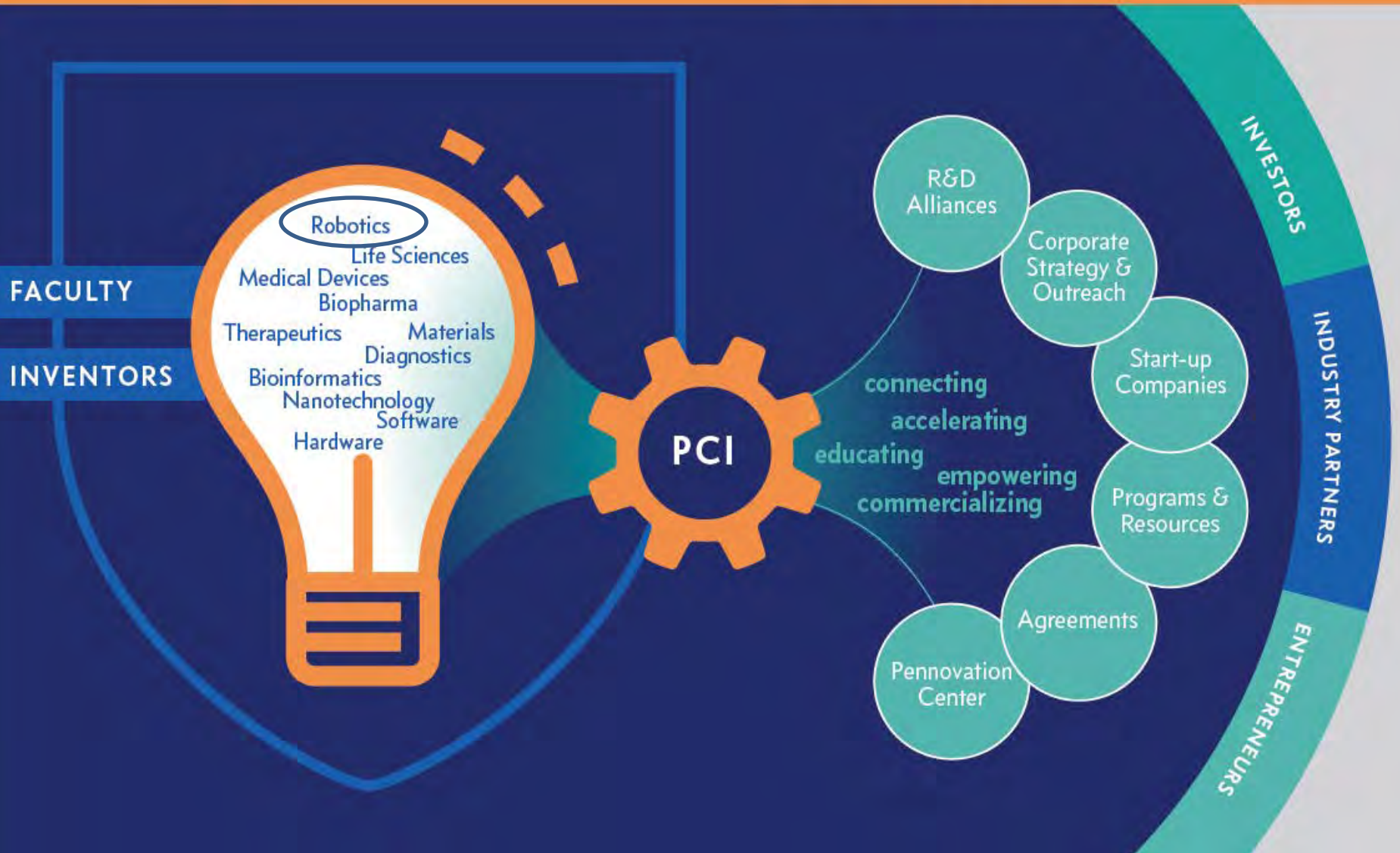




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# Research institutions lead the way ...

## empowering ideas





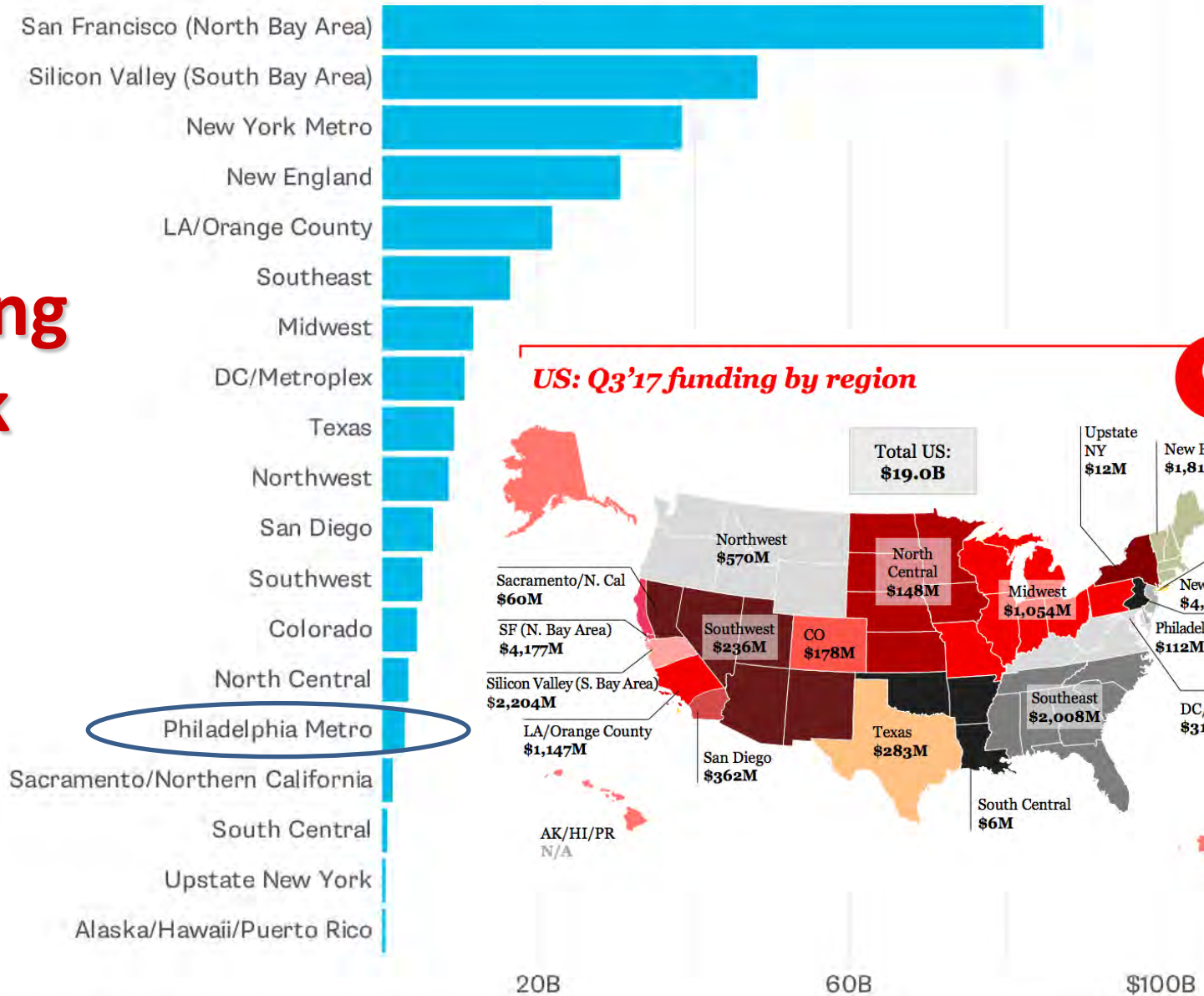
# Research institutions matter

|  | Number of top-ranked science programs | Patents per million residents, 2007-2011 | Institution with Most Top Programs         |
|--|---------------------------------------|--|--|
| Boston-Cambridge-Quincy, MA-NH                     | 43                                    | 874                                      | Harvard University                         |
| San Francisco-Oakland-Fremont, CA                  | 33                                    | 1,630                                    | University of California-Berkeley          |
| Los Angeles-Long Beach-Santa Ana, CA               | 30                                    | 423                                      | California Institute of Technology         |
| San Jose-Sunnyvale-Santa Clara, CA                 | 24                                    | 5,035                                    | Stanford University                        |
| New Haven-Milford, CT                              | 15                                    | 590                                      | Yale University                            |
| Trenton-Ewing, NJ                                  | 13                                    | 1,072                                    | Princeton University                       |
| Ann Arbor, MI                                      | 12                                    | 1,690                                    | University of Michigan-Ann Arbor           |
| Durham-Chapel Hill, NC                             | 11                                    | 838                                      | University of North Carolina, Chapel Hill  |
| Madison, WI  | 11                                    | 1,112                                    | University of Wisconsin-Madison            |
| Chicago-Joliet-Naperville, IL-IN-WI                | 10                                    | 408                                      | University of Chicago                      |
| New York-Northern New Jersey-Long Island, NY-NJ-PA | 10                                    | 365                                      | Columbia University                        |
| Champaign-Urbana, IL                               | 9                                     | 414                                      | University of Illinois at Urbana-Champaign |
| State College, PA                                  | 9                                     | 597                                      | Penn State University                      |
| San Diego-Carlsbad-San Marcos, CA                  | 8                                     | 1,035                                    | University of California-San Diego         |
| Seattle-Tacoma-Bellevue, WA                        | 8                                     | 1,165                                    | University of Washington                   |
| Ithaca, NY   | 7                                     | 401                                      | Cornell University                         |
| Philadelphia-Camden-Wilmington, PA-NJ-DE-MD        | 7                                     | 959                                      | University of Pennsylvania                 |
| Santa Barbara-Santa Maria-Goleta, CA               | 7                                     | 652                                      | University of California-Santa Barbara     |
| Atlanta-Sandy Springs-Marietta, GA                 | 6                                     | 283                                      | Georgia Institute of Technology            |
| Sacramento--Arden-Arcade--Roseville, CA            | 6                                     | 184                                      | University of California-Davis             |

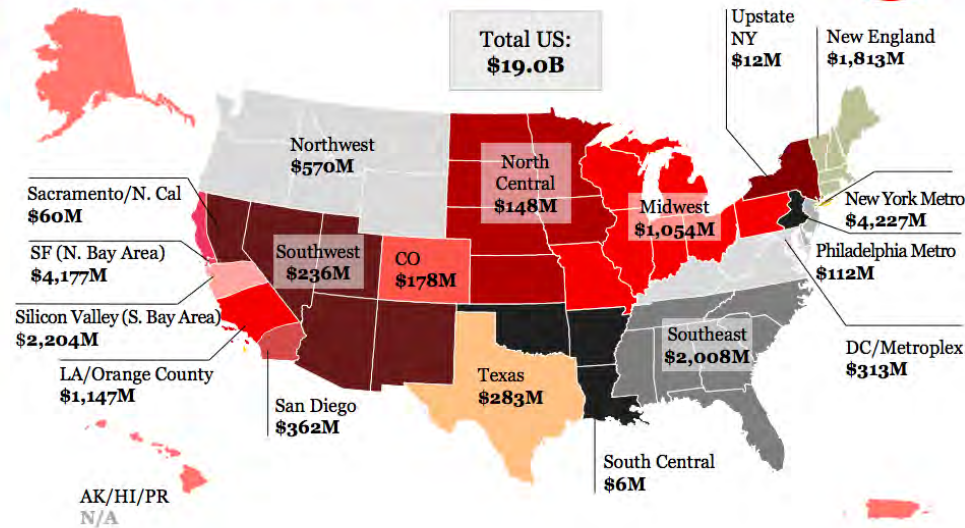
# The Biggest VC Magnets

Venture capital investment by region, 2013 through 2017

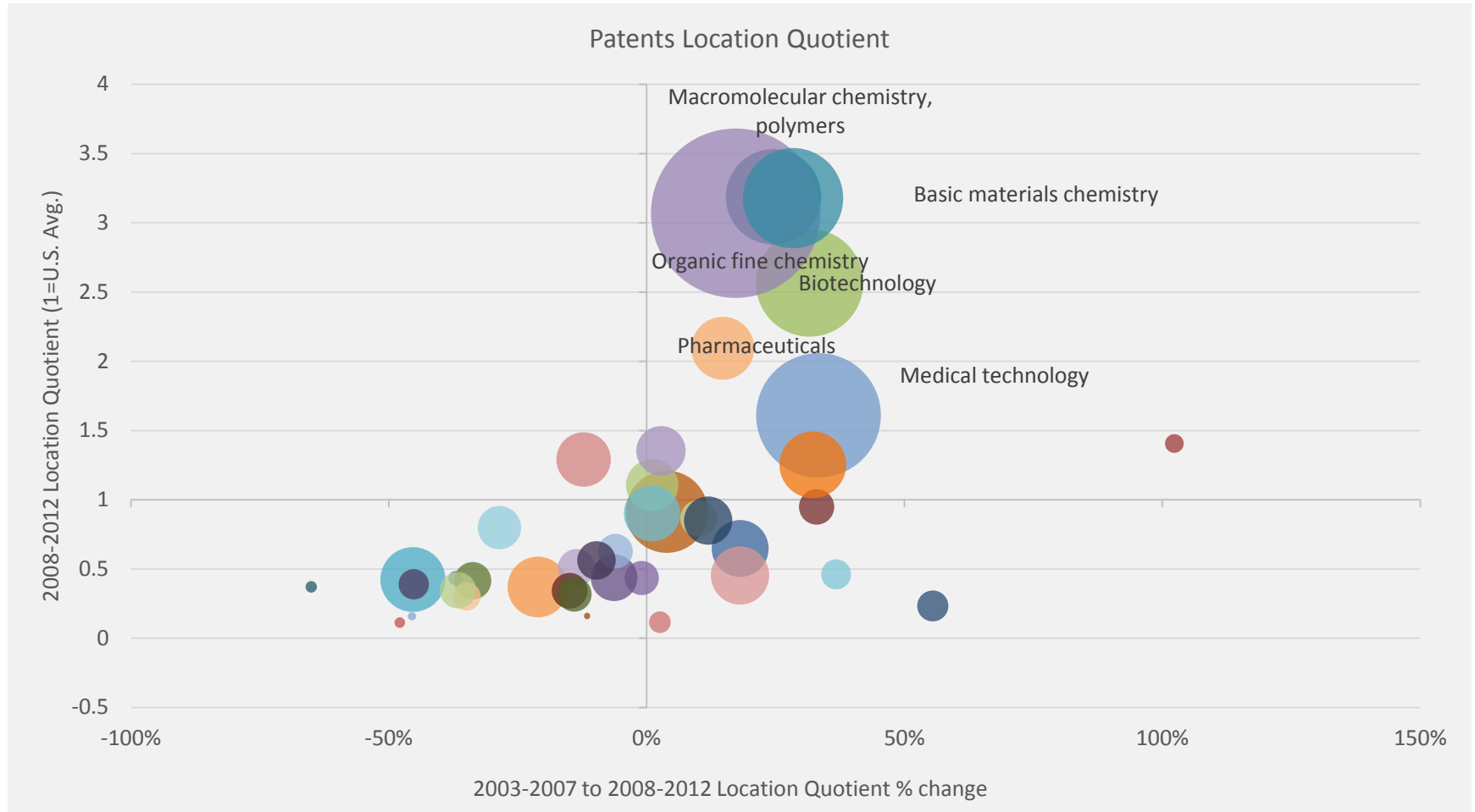
But  
financing  
is weak



US: Q3'17 funding by region



# Biopharma anchors Philadelphia's innovation eco-system

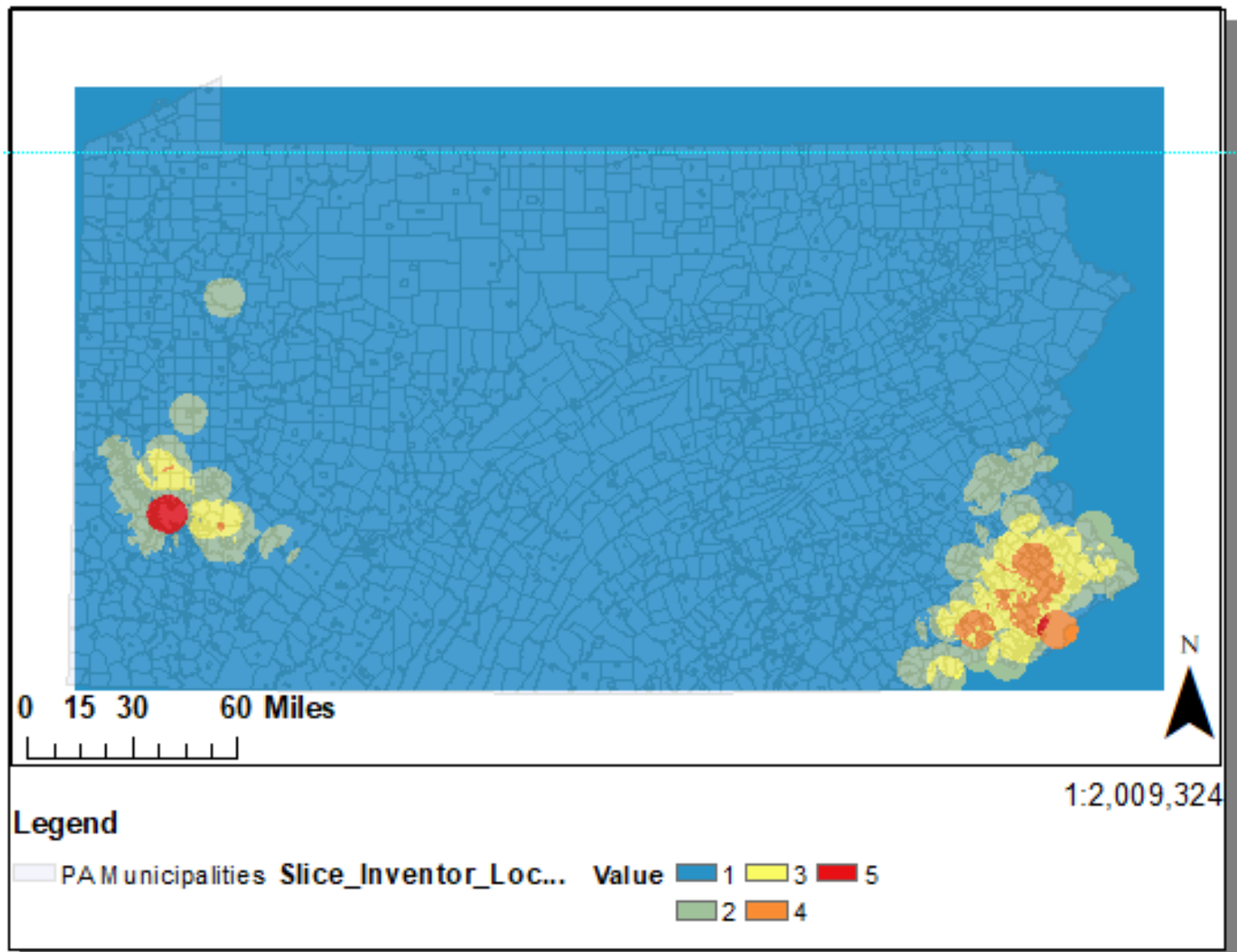




# Philadelphia – comparative analysis

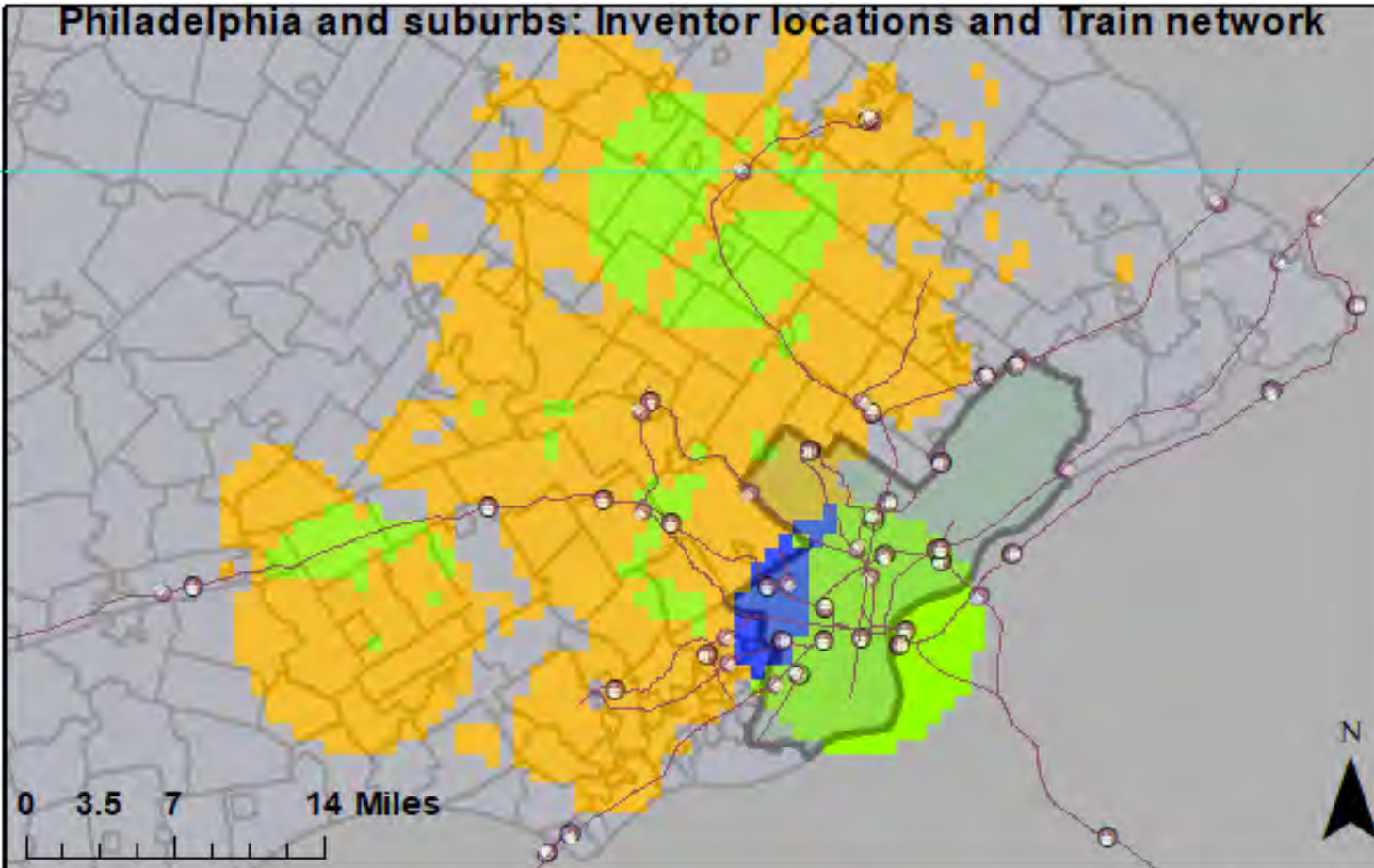
|  | Average Granted Patents<br>per year, 2007-2011 | Patents per million<br>residents, 2007-2011 | Largest subcategory<br>of patents |
|--|--|---|-----------------------------------|
| San Jose-Sunnyvale-Santa Clara, CA                 | 9,237  | 5,066                                       | Computer Hardware & Peripherals   |
| San Francisco-Oakland-Fremont, CA                  | 7,003  | 1,638                                       | Biotechnology                     |
| New York-Northern New Jersey-Long Island, NY-NJ-PA | 6,907  | 366   | Communications                    |
| Los Angeles-Long Beach-Santa Ana, CA               | 5,456  | 424   | Communications                    |
| Seattle-Tacoma-Bellevue, WA                        | 3,968  | 1,174                                       | Computer Software                 |
| Boston-Cambridge-Quincy, MA-NH                     | 3,965  | 877   | Biotechnology                     |
| Chicago-Joliet-Naperville, IL-IN-WI                | 3,886  | 409   | Communications                    |
| San Diego-Carlsbad-San Marcos, CA                  | 3,165  | 1,041                                       | Communications                    |
| Minneapolis-St. Paul-Bloomington, MN-WI            | 3,068  | 945   | Surgery & Medical Instruments     |
| Detroit-Warren-Livonia, MI                         | 2,720  | 621   | Transportation                    |
| Austin-Round Rock-San Marcos, TX                   | 2,497  | 1,503                                       | Computer Hardware & Peripherals   |
| Philadelphia-Camden-Wilmington, PA-NJ-DE-MD        | 2,370  | 402   | Biotechnology                     |
| Houston-Sugar Land-Baytown, TX                     | 2,202  | 379   | Earth Working & Wells             |
| Dallas-Fort Worth-Arlington, TX                    | 1,945  | 310   | Communications                    |
| Portland-Vancouver-Hillsboro, OR-WA                | 1,844  | 837   | Computer Hardware & Peripherals   |
| Atlanta-Sandy Springs-Marietta, GA                 | 1,506  | 285   | Communications                    |
| Washington-Arlington-Alexandria, DC-VA-MD-WV       | 1,479  | 271   | Communications                    |
| Phoenix-Mesa-Glendale, AZ                          | 1,437  | 343   | Semiconductor Devices             |
| Raleigh-Cary, NC                                   | 1,273  | 1,164                                       | Computer Hardware & Peripherals   |
| Poughkeepsie-Newburgh-Middletown, NY               | 1,226  | 1,829                                       | Semiconductor Devices             |
| Average of all metropolitan areas                  | 299  | 296   |                                   |

# Pennsylvania inventor location

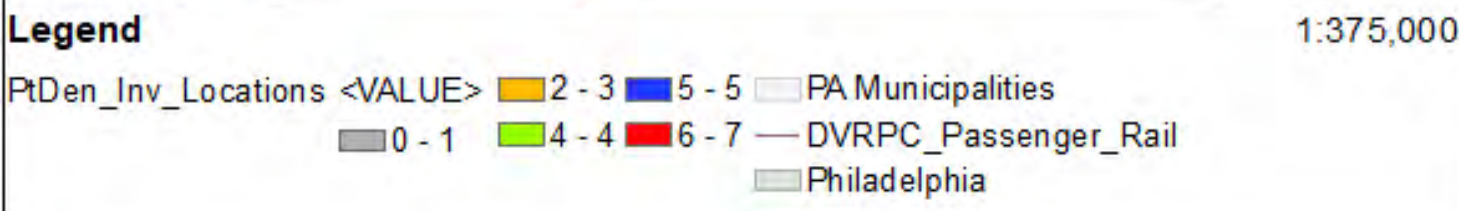




# Philadelphia Mass Transit and Inventor Locations



More than road network density, the location of inventor residences is determined by RAIL public transport availability in Philadelphia. The inventor locations are clearly along the SEPTA regional rail and subway routes in Philadelphia





# Core-Periphery connectivity

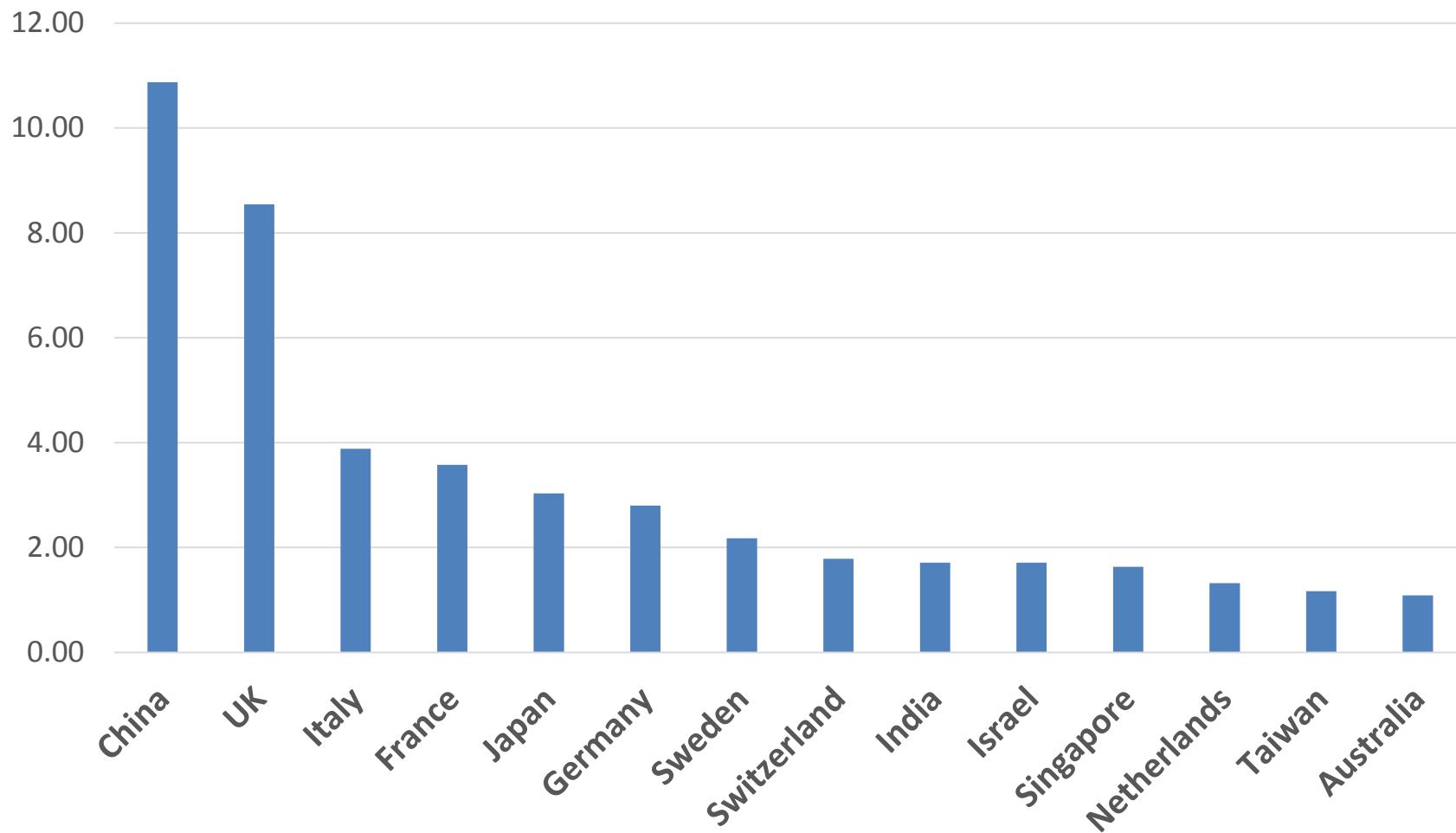
|              |              | 2005        | 2006        | 2007        | 2008        | 2009        | 2010        | Average        |
|--------------|--------------|-------------|-------------|-------------|-------------|-------------|-------------|----------------|
| Philadelphia | Suburb       | 1569        | 1732        | 1747        | 1626        | 1613        | 1832        | 1686.50        |
|              | Philadelphia | 309         | 352         | 337         | 310         | 333         | 349         | 331.67         |
|              | Co-patent    | 102         | 103         | 106         | 113         | 99          | 92          | 102.50         |
|              | <b>Total</b> | <b>1776</b> | <b>1981</b> | <b>1978</b> | <b>1823</b> | <b>1847</b> | <b>2089</b> | <b>1915.67</b> |
|              | Center %     | 17.40%      | 17.77%      | 17.04%      | 17.00%      | 18.03%      | 16.71%      | 17.31%         |
|              | Co-patent %  | 5.74%       | 5.20%       | 5.36%       | 6.20%       | 5.36%       | 4.40%       | 5.35%          |
| San Diego    | Suburb       | 2095        | 2293        | 2507        | 2313        | 2396        | 2521        | 2354.17        |
|              | San Diego    | 2249        | 2683        | 2934        | 3002        | 3148        | 3234        | 2875.00        |
|              | Co-patent    | 863         | 971         | 1129        | 1032        | 1102        | 1077        | 1029.00        |
|              | <b>Total</b> | <b>3481</b> | <b>4005</b> | <b>4312</b> | <b>4283</b> | <b>4442</b> | <b>4678</b> | <b>4200.17</b> |
|              | Center %     | 64.61%      | 66.99%      | 68.04%      | 70.09%      | 70.87%      | 69.13%      | 68.45%         |
|              | Co-patent %  | 24.79%      | 24.24%      | 26.18%      | 24.10%      | 24.81%      | 23.02%      | 24.50%         |
| Pittsburgh   | Suburb       | 767         | 799         | 875         | 761         | 790         | 906         | 816.33         |
|              | Pittsburgh   | 464         | 519         | 572         | 533         | 517         | 578         | 530.50         |
|              | Co-patents   | 217         | 234         | 264         | 212         | 216         | 247         | 231.67         |
|              | <b>Total</b> | <b>1014</b> | <b>1084</b> | <b>1183</b> | <b>1082</b> | <b>1091</b> | <b>1237</b> | <b>1115.17</b> |
|              | Center %     | 45.76%      | 47.88%      | 48.35%      | 49.26%      | 47.39%      | 46.73%      | 47.57%         |
|              | Co-patent %  | 21.40%      | 21.59%      | 22.32%      | 19.59%      | 19.80%      | 19.97%      | 20.77%         |



# Global co-inventor connectivity – 1

|    | <u>Country</u> | <u>Share of Connected Patents</u> |
|----|----------------|-----------------------------------|
| 1  | China          | 10.87                             |
| 2  | UK             | 8.54                              |
| 3  | Italy          | 3.88                              |
| 4  | France         | 3.57                              |
| 5  | Japan          | 3.03                              |
| 6  | Germany        | 2.80                              |
| 7  | Sweden         | 2.17                              |
| 8  | Switzerland    | 1.79                              |
| 9  | India          | 1.71                              |
| 10 | Israel         | 1.71                              |
| 11 | Singapore      | 1.63                              |
| 12 | Netherlands    | 1.32                              |
| 13 | Taiwan         | 1.17                              |
| 14 | Australia      | 1.09                              |
|    |                | 45.28                             |

# Global co-inventor connectivity – 2



# Concluding remarks

- Innovation is the engine of local economic systems. It drives
  - Job growth
  - Wage growth
- It depends on
  - World class educational / research institutions
  - Local and global connectivity
  - Flexibility in adapting to technological change

# Exports and Imports

Exports and Imports of pharmaceuticals & medicines from/to Pennsylvania (2012-2016)

Exports

Total 0 1,579,894,334



Imports

Total - 17,787,477,829



Top 5: United Kingdom, Netherlands, Canada, Belgium, Switzerland

Top 5: Israel, Switzerland, Germany, Ireland, India

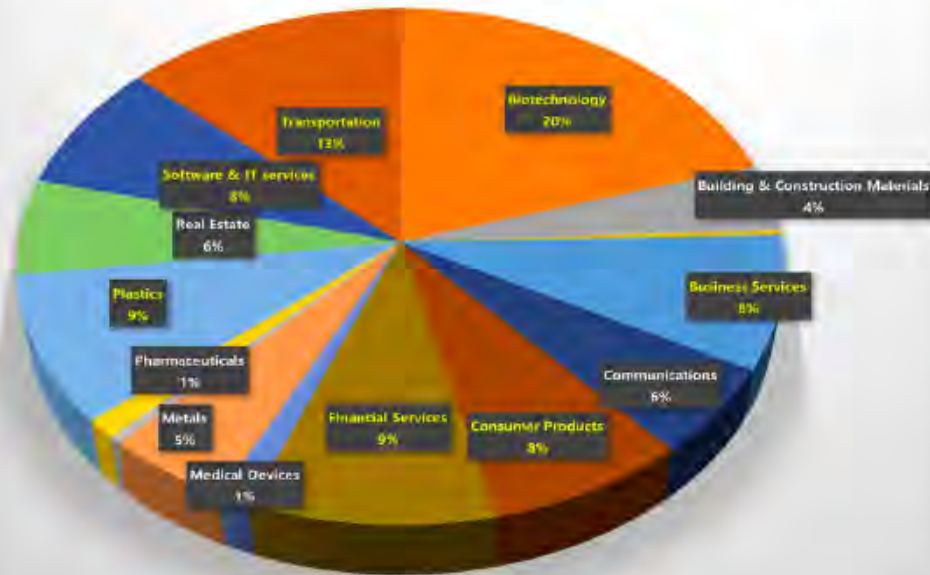
➔ Trade data suggest strong relationships with Western European countries and Canada



# Foreign Direct Investment

## FDI inflows

Philadelphia FDI inflow by sector (2013-2015 mid)



Global Top 20 FDI destinations (2009-2015 mid)

| Rank         | Biotechnology     | FDI in USD mil. | Percentage |
|--------------|-------------------|-----------------|------------|
| 1            | Shanghai          | 1526.66         | 16.12%     |
| 2            | Singapore         | 968.816         | 10.23%     |
| 3            | Suzhou            | 856.123         | 9.04%      |
| 4            | Boston            | 541.911         | 5.72%      |
| 5            | Beijing           | 518.425         | 5.48%      |
| 6            | Washington        | 506.035         | 5.34%      |
| 7            | Munich            | 463.802         | 4.90%      |
| 8            | Wuxi              | 451.776         | 4.77%      |
| 9            | Seattle           | 229.804         | 2.43%      |
| 10           | Frankfurt am Main | 224.709         | 2.37%      |
| 11           | San Diego         | 218.269         | 2.31%      |
| 12           | Philadelphia      | 181.517         | 1.92%      |
| 13           | Karlsruhe         | 164.244         | 1.74%      |
| 14           | Montreal          | 156.79          | 1.66%      |
| 15           | New York          | 151.492         | 1.60%      |
| 16           | Seoul-Incheon     | 131.26          | 1.39%      |
| 17           | Portland          | 125             | 1.32%      |
| 18           | Berlin            | 123.276         | 1.30%      |
| 19           | Istanbul          | 114.269         | 1.21%      |
| 20           | Nanjing           | 108.656         | 1.15%      |
| Global Total |                   | 9468.438        |            |

| Rank         | Pharmaceuticals | FDI in USD mil. | Percentage |
|--------------|-----------------|-----------------|------------|
| 1            | Singapore       | 4409.464        | 19.32%     |
| 2            | Boston          | 1851.065        | 8.11%      |
| 3            | Shanghai        | 1801.782        | 7.89%      |
| 4            | Suzhou          | 815.896         | 3.57%      |
| 5            | Beijing         | 766.959         | 3.36%      |
| 6            | Toronto         | 737.731         | 3.23%      |
| 7            | New York        | 636.677         | 2.79%      |
| 8            | Dalian          | 625.119         | 2.74%      |
| 9            | Brussels        | 567.786         | 2.49%      |
| 10           | Rio de Janeiro  | 462.94          | 2.03%      |
| 11           | Barcelona       | 452.364         | 1.98%      |
| 12           | Guangzhou       | 418.38          | 1.83%      |
| 13           | Montreal        | 397.745         | 1.74%      |
| 14           | San Francisco   | 358.373         | 1.57%      |
| 15           | Philadelphia    | 339.785         | 1.49%      |
| 16           | Atlanta         | 337.074         | 1.48%      |
| 17           | London          | 325.662         | 1.43%      |
| 18           | Tianjin         | 317.117         | 1.39%      |
| 19           | Hangzhou        | 315.621         | 1.38%      |
| 20           | Mexico City     | 298.968         | 1.31%      |
| Global Total |                 | 22827.416       |            |



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## NETWORKING EVENTS

### World Trade Centers Day Awards and Celebration



2018 Global Business Leadership Award –  
Holt Logistics Corp.

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**Companies we serve become part of  
our region's global success,  
enhancing lives around the world.**



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# WTC Accra, Ghana







WTC  
Bangalore,  
India



## WTC Taipei, Taiwan



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City, India



WTC Noida,  
India

# WTC Haikou, China





# WTC Nanjing, China







## WTC Twente, Netherlands

# WTC Hamburg, Germany





## WTC Abuja, Nigeria

# World Trade Center Denver





# *GLOBAL CONNECTIONS, LOCAL GROWTH* **THE WTCA TRADE AND INVESTMENT REPORT 2018**

[wtca.org](http://wtca.org)



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## **Trade and Investment Report reveals networks, human capital and connective infrastructure as key variables in member cities**

- **Urban outperformers create cities without borders**
- **Planes, brains and connectivity**
- **Small companies are big business**

# THE GREATER PHILADELPHIA EXPORT PLAN | GLOBAL CITIES INITIATIVE | BROOKINGS INSTITUTION AND JPMORGAN CHASE

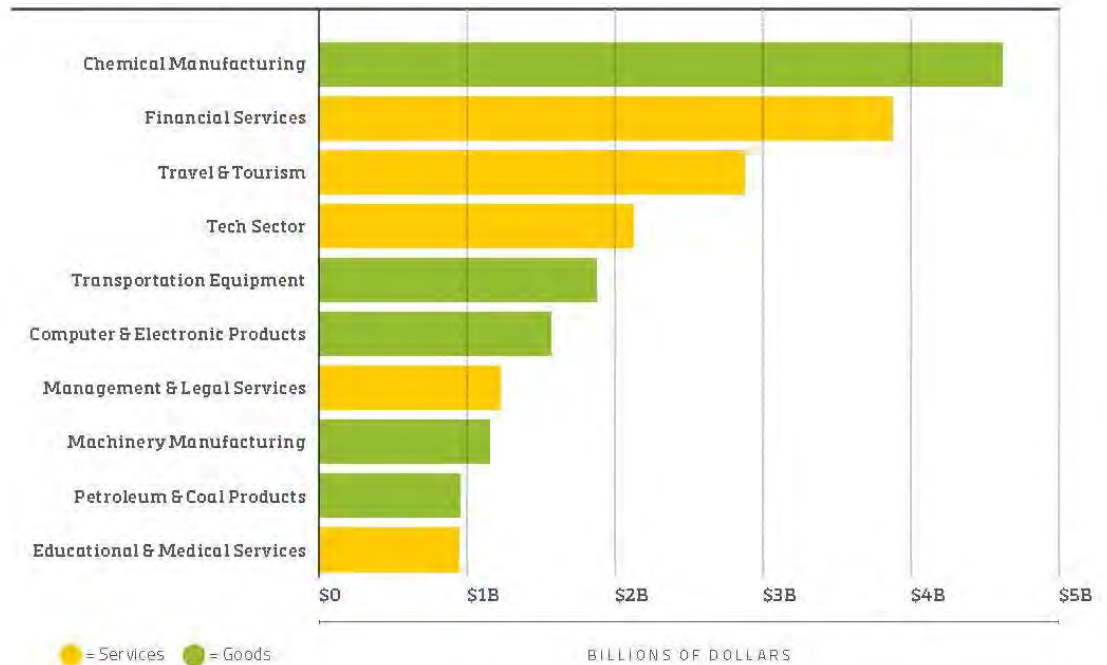


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# GREATER PHILADELPHIA: A \$32 billion export market



GREATER PHILADELPHIA'S LARGEST EXPORT INDUSTRIES (2014)



Source: Brookings Export Monitor 2015

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# GREATER PHILADELPHIA EXPORT PLAN

**GOAL:** Accelerate regional job and revenue growth via a dynamic export economy

## **OBJECTIVES:**

1. Increase Greater Philadelphia's export intensity to match or exceed the average for the top 100 U.S. metros within five years
2. Increase the number of identified new exporting firms in the region by 10 percent within five years
3. Elevate exports as a top-of-mind economic development priority among regional leaders within three years

# GREATER PHILADELPHIA EXPORT PLAN

## PRIORITY STRATEGIES:

1. Build Export Awareness and Capacity among the Region's Small and Mid-Sized Businesses
2. Catalyze Export Growth in the Region's Health and Professional Services Clusters
3. Strengthen and Enhance Coordination within Greater Philadelphia's Export Support Ecosystem

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Department of  
**Commerce**

CITY OF PHILADELPHIA

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# PHILADELPHIA

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2018

# WHAT DO WE DO

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## Promote Philadelphia

- Location
- Value
- Talent



## Promote Exports

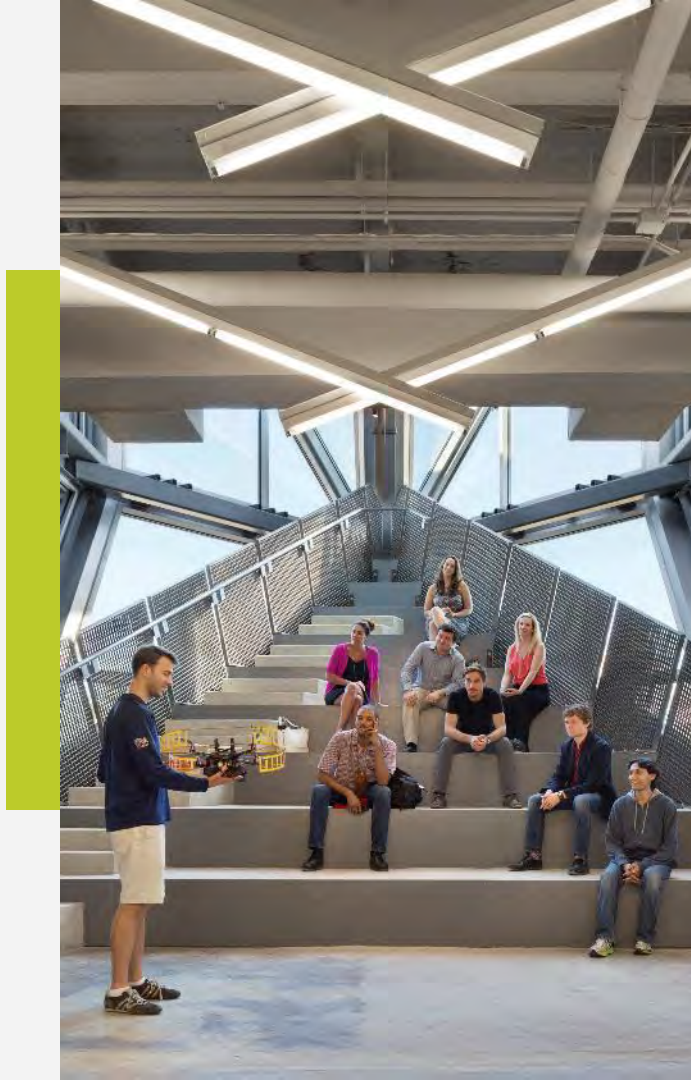
## Support Airport & Port Routes

## International Delegations

## Global Relationship Building

# HOW WE DO IT

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**Relationships**

Introductions

Data

Partnerships

Incentives

“Aftercare”

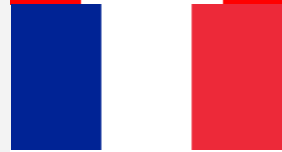


**WHERE DO  
COMPANIES  
COME FROM**

**Global**

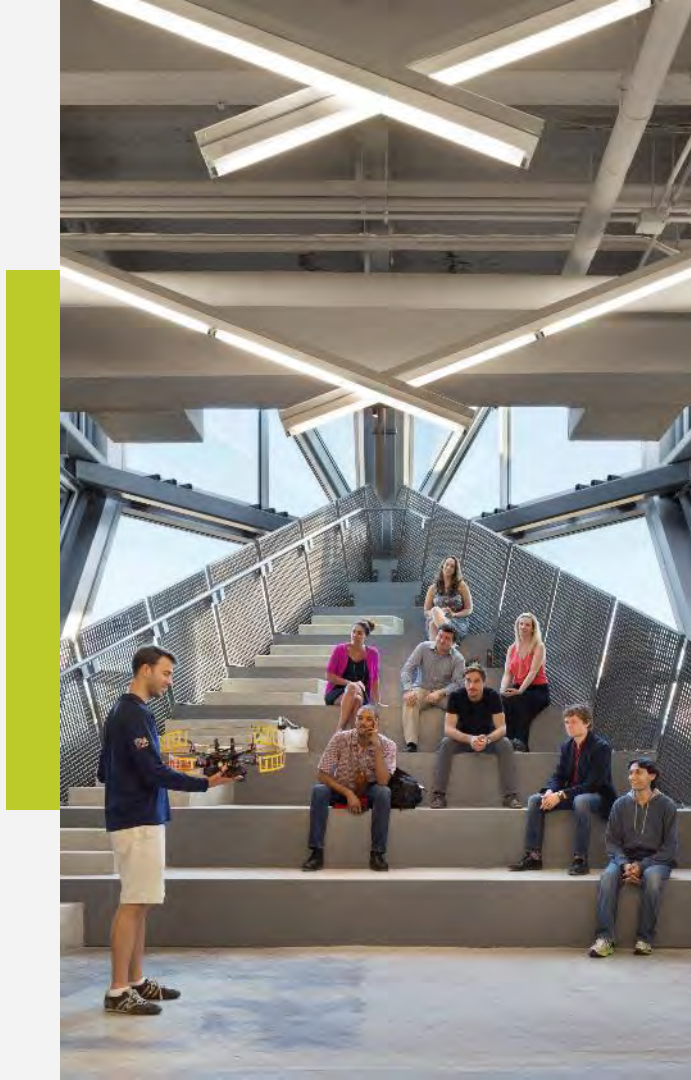
**Domestic U.S.**

**Regional**



# WHICH SECTORS

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**Life Science**

**Research & Development**

**Tech/ Innovation**

**Advanced Manufacturing**

**Professional Services**

## **METRICS**

---

**49 WINS = 2,330 JOBS**

---

**215 COMPANIES IN THE PIPELINE**

---

**HOSTED BUSINESSES & DELEGATIONS  
FROM 35 COUNTRIES**

---

**2 OUTBOUND MISSIONS**

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# CHALLENGES

---

**Global... “Flux”**

**US Policy**

**Uncertainty**

**Tax Environment**

**Competition**

**Global Identity**

# OPPORTUNITIES

---

**Global... “Flux”**

**Philadelphia’s Welcoming Policy**

**Diverse Workforce**

**Renaissance**

**Deep + Long History**

**Global Identity Project**

**THE FUTURE?**



**Will Philadelphia  
accelerate?**

**Competitor Cities**

**US International Policy**



# THANK YOU

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**LAUREN SWARTZ**

SENIOR DIRECTOR, INTERNATIONAL BUSINESS  
CITY OF PHILADELPHIA, DEPARTMENT OF COMMERCE