Threading the Innovation Chain

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- Melik Demirel (Penn State)

US Innovation System: quick history

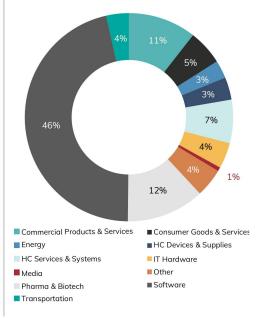


nvca

Data provided by PitchBook

2024 Top States by VC Capital Raised | 2024 US VC Deals by Sector (\$B)

| Initial Initial New York 93 \$14,984,7 Massachusetts 26 \$6,190.0 Illinois 24 \$4,712.2 Texas 35 \$1,304.6 Florida 27 \$1,300.2 Washington 12 \$1,017.5 Virginia 9 \$742.6 New Jersey 4 \$449.5 New Jersey 4 \$449.5 North Carolina 3 \$333.0 Colorada 5 \$325.2 District of Columbia 3 \$264.8 Connecticut 6 \$256.9 Delaware 4 \$152.4 Wisconsin 5 \$143.5 Indiana 1 \$125.0 Michigan 3 \$10.0 Arizona 1 \$10.0 Ohio 6 \$10.0 Pennsylvania 1 \$60.0 Pennsylvania 1 \$60.0 | | # of Funds | Capital Raised (\$M) |
|--|----------------------|------------|----------------------|
| Instrumt Instrumt Massachusetts 26 \$6,190.0 Illinois 24 \$4,712.2 Texas 35 \$1,304.6 Florida 27 \$1,300.2 Wassington 12 \$1,017.5 Wirginia 9 \$742.6 Nevada 3 \$472.0 New Jersey 4 \$449.5 North Carolina 3 \$333.0 Colorado 5 \$325.2 District of Columbia 3 \$281.1 Georgia 7 \$264.8 Connecticut 6 \$256.9 Delaware 4 \$152.4 Wisconsin 5 \$143.5 Indiana 1 \$125.0 Mortana 1 \$10.0 Arizona 1 \$10.0 Arizona 6 \$81.0 Pennsylvania 1 \$60.0 | California | 197 | \$43,075.7 |
| Initialization Initialization Illinois 24 \$4,712.2 Texas 35 \$1,344.6 Florida 27 \$1,300.2 Woshington 12 \$1,017.5 Woshington 12 \$449.5 Nevada 3 \$4472.0 New Jersey 4 \$449.5 North Carolina 3 \$333.0 Colorado 5 \$325.2 District of Columbia 3 \$281.1 Georgia 7 \$264.8 Connecticut 6 \$256.9 Delaware 4 \$152.4 Wisconsin 5 \$143.5 Indiana 1 \$125.0 Michigan 3 \$100.0 Arizona 1 \$100.0 Arizona 6 \$25.0 Ohio 6 \$10.0 Pennsylvania 1 \$60.0 Pennsylvania 1 \$80.0 | New York | 93 | \$14,984.7 |
| Texas 35 \$1,344.6 Florida 27 \$1,300.2 Woshington 12 \$1,017.5 Wirginia 9 \$742.6 Nevada 3 \$472.0 New Jersey 4 \$449.5 North Carolina 3 \$333.0 Colorado 5 \$325.2 District of Columbia 3 \$264.8 Connecticut 6 \$256.9 Delaware 4 \$152.4 Wisconsin 5 \$143.5 Indiana 1 \$125.0 Michigan 3 \$100.0 Arizona 1 \$100.0 Pennsylvonia 6 \$81.0 Pennsylvonia 1 \$60.0 | Massachusetts | 26 | \$6,190.0 |
| Florida 27 \$1,300.2 Washington 12 \$1,017.5 Virginia 9 \$742.6 Nevada 3 \$472.0 New Jersey 4 \$449.5 North Carolina 3 \$333.0 Colorado 5 \$325.2 District of Columbia 3 \$264.8 Connecticut 6 \$256.9 Delaware 4 \$152.4 Wisconsin 5 \$143.5 Indiana 1 \$120.0 Mortana 1 \$100.0 Arizona 6 \$81.0 Ohio 6 \$60.0 Pennsylvania 1 \$50.0 | Illinois | 24 | \$4,712.2 |
| Virginiq 12 \$1,017.5 Virginiq 9 \$742.6 Nevada 3 \$472.0 New Jersey 4 \$449.5 North Carolina 3 \$333.0 Colorado 5 \$255.2 District of Columbia 3 \$264.8 Connecticut 6 \$256.9 Delaware 4 \$152.4 Wisconsin 5 \$143.5 Indiana 1 \$125.0 Michigan 3 \$100.0 Arizona 1 \$85.0 Ohio 6 \$10.0 Pennsylvonia 1 \$50.0 | Texas | 35 | \$1,344.6 |
| Virginia 9 \$742.6 Nevada 3 \$472.0 New Jersey 4 \$449.5 North Carolina 3 \$333.0 Colorado 5 \$255.2 District of Columbia 3 \$264.8 Connecticut 6 \$256.9 Delaware 4 \$152.4 Wisconsin 5 \$143.5 Indiana 1 \$125.0 Mortana 1 \$100.0 Arizona 1 \$85.0 Ohio 6 \$81.0 Pennsylvonia 1 \$50.0 | Florida | 27 | \$1,300.2 |
| Nevada 3 \$472.0 New Jersey 4 \$449.5 North Carolina 3 \$333.0 Colorado 5 \$325.2 District of Columbia 3 \$281.1 Georgia 7 \$264.8 Connecticut 6 \$256.9 Delaware 4 \$152.4 Wisconsin 5 \$143.5 Indiana 1 \$102.0 Michigan 3 \$100.0 Arizona 1 \$85.0 Ohio 6 \$81.0 Pennsylvonia 1 \$50.0 Tennessee 2 \$38.1 | Washington | 12 | \$1,017.5 |
| New Jersey 4 \$ 449.5 North Carolina 3 \$ 333.0 Colorado 5 \$ 325.2 District of Columbia 3 \$ 281.1 Georgia 7 \$ 264.8 Connecticut 6 \$ 256.9 Delaware 4 \$ 152.4 Wisconsin 5 \$ 143.5 Indiana 1 \$ 102.0 Michigan 3 \$ 510.0 Arizona 1 \$ 85.0 Ohio 6 \$ 81.0 Pennsylvonia 1 \$ 50.0 Tennessee 2 \$ 38.1 | Virginia | 9 | \$742.6 |
| North Carolina 3 \$333.0 Colorado 5 \$325.2 District of Columbia 3 \$281.1 Georgia 7 \$264.8 Connecticut 6 \$256.9 Delaware 4 \$152.4 Wisconsin 5 \$143.5 Indiana 1 \$102.0 Michigan 3 \$100.0 Arizona 1 \$85.0 Ohio 6 \$81.0 Pennsylvania 1 \$50.0 Tennessee 2 \$38.1 | Nevada | 3 | \$472.0 |
| Image: Colorado 5 \$325.2 District of Columbia 3 \$281.1 Georgia 7 \$264.8 Connecticut 6 \$256.9 Delaware 4 \$152.4 Wisconsin 5 \$143.5 Indiana 1 \$102.0 Michigan 3 \$100.0 Arizona 1 \$85.0 Ohio 6 \$81.0 Pennsylvania 1 \$50.0 Tennessee 2 \$38.1 | New Jersey | 4 | \$449.5 |
| District of Columbia 3 \$281.1 Georgia 7 \$264.8 Connecticut 6 \$256.9 Delaware 4 \$152.4 Wisconsin 5 \$143.5 Indiana 1 \$102.0 Michigan 3 \$100.0 Arizona 1 \$85.0 Ohio 6 \$81.0 Pennsylvania 1 \$50.0 Tennessee 2 \$38.1 | North Carolina | 3 | \$333.0 |
| Georgia 7 \$264.8 Connecticut 6 \$256.9 Delaware 4 \$152.4 Wisconsin 5 \$143.5 Indiana 1 \$125.0 Montana 1 \$100.0 Arizona 1 \$85.0 Ohio 6 \$81.0 Pennsylvania 1 \$50.0 Tennessee 2 \$38.1 | Colorado | 5 | \$325.2 |
| Connecticut 6 \$256.9 Delaware 4 \$152.4 Wisconsin 5 \$143.5 Indiana 1 \$125.0 Montana 1 \$100.0 Arizona 1 \$85.0 Ohio 6 \$81.0 Pennsylvania 1 \$50.0 Tennessee 2 \$38.1 | District of Columbia | 3 | \$281.1 |
| Delaware 4 \$152.4 Wisconsin 5 \$143.5 Indiana 1 \$125.0 Montana 1 \$102.0 Michigan 3 \$100.0 Arizona 1 \$85.0 Ohio 6 \$81.0 Pennsylvania 1 \$50.0 Tennessee 2 \$38.1 | Georgia | 7 | \$264.8 |
| Wisconsin 5 \$143.5 Indiana 1 \$125.0 Montana 1 \$102.0 Michigan 3 \$100.0 Arizona 1 \$85.0 Ohio 6 \$81.0 Pennsylvania 1 \$50.0 Tennessee 2 \$38.1 | Connecticut | 6 | \$256.9 |
| Indiana 1 \$125.0 Montana 1 \$102.0 Michigan 3 \$100.0 Arizona 1 \$85.0 Ohio 6 \$81.0 Pennsylvania 1 \$50.0 Tennessee 2 \$38.1 | Delaware | 4 | \$152.4 |
| Image: Constraint of the system Image: Constraint of the system Michigan 1 \$102.0 Michigan 3 \$100.0 Arizona 1 \$85.0 Ohio 6 \$81.0 Pennsylvania 1 \$50.0 Tennessee 2 \$38.1 | Wisconsin | 5 | \$143.5 |
| Michigan 3 \$100.0 Arizona 1 \$85.0 Ohio 6 \$81.0 Pennsylvania 1 \$50.0 Tennessee 2 \$38.1 | Indiana | 1 | \$125.0 |
| Arizona 1 \$85.0 Ohio 6 \$81.0 Pennsylvania 1 \$50.0 Tennessee 2 \$38.1 | Montana | 1 | \$102.0 |
| Ohio 6 \$81.0 Pennsylvania 1 \$50.0 Tennessee 2 \$38.1 | Michigan | 3 | \$100.0 |
| Pennsylvania 1 \$50.0 Tennessee 2 \$38.1 | Arizona | 1 | \$85.0 |
| Tennessee 2 \$38.1 | Ohio | 6 | \$81.0 |
| | Pennsylvania | 1 | \$50.0 |
| Kentucky 1 \$33.0 | Tennessee | 2 | \$38.1 |
| | Kentucky | 1 | \$33.0 |



Source: NVCA 2025 Yearbook, Data provided by PitchBook *Other industry groups below:

Commercial Products, Commercial Transportation, Other Business Products and Services, Consumer Durables, Consumer Non-Durables, Services (Non-Financial), Transportation, Other Consumer Products and Services, Utilies, Other Fenergy, Capital Markets/Institutions, Commercial Banks, Insurance, Other Financial Services, Other Healthcare, IT Services, Other Information Technology, Agriculture, Chemicals and Gases, Construction (Non-Wood), Containers and Packaging, Forsetry, Media, Minerals and Mining, Textiles, Other Materials

Source: NVCA 2025 Yearbook, Data provided by PitchBook

Advanced Manufacturing Capital Requirements

TRL 1–3: \$1 million, basic science/innovation TRL 4–7: \$10 million, valley of death TRL 8–9: \$100 million, factory scale

Introducing PRL

POLICY READINESS LEVELS

State Capacity

Institutional depth and technical knowledge

• Political Readiness Level

Are politicians ready to embrace and implement the policy?

• Public readiness levels.

Media support? Received wisdom?

PRL (continued)

PRL 1: Think tank White Paper. Journal article.

PRL 2-3: Actual plan

PRL 4-7: Governmental buy-in but not implemented at scale

- PRL 4: state level (US)
- PRL 5: multi state level (US)
- PRL 6-7: Federal Government (US) pilot

PRL 8-9: Federal Government Policies implemented at scale

PRL VALLEY OF DEATH