Innovation Policy as a Strategy for US Competitiveness

AUTHOR

Luke Pardue[1]

ABSTRACT

New innovations drive increases in productivity, economic output, and standards of living. In a system established in the US after World War II, American businesses, academic institutions, and the federal government work together with varying levels of intensity at each stage of the innovation pipeline, from basic research to commercialization. Today, the US remains a leader in creating new innovations and in bringing them to scale through the country's deep, liquid capital markets. But there is also evidence that in recent years, new technological developments require greater research inputs and the link between these innovations and economic growth has weakened. This piece first lays out how the US innovation process operates today and then proposes four broad strategies to improve America's innovation ecosystem: creating a wider array of institutions where scientific research is funded and performed, smoothing the process of commercializing new innovations, working to create more innovation clusters across the country, and fostering the development and commercialization of innovations in critical industries that exhibit large spillover effects and where productivity is lagging.

[1] Policy Director, Aspen Economic Strategy Group

Introduction: Why Innovation Matters

Technological innovations drive productivity growth, which in turn drives economic growth and rising living standards. While private firms have a clear incentive to invest in innovation – new advances differentiate products and drive business growth – there is also a rationale for the public sector to promote technological advances. New ideas have spillover effects, for example they may have additional applications beyond the inventor's intention or may lead to follow-on innovations, which means that their broader social value is higher than the value to any individual or firm.

In a system established in the US during the post-World War II race for global economic and military dominance, US businesses, academic institutions, and the federal government work together with varying levels of intensity at each stage of the innovation pipeline, from basic research to commercialization. The federal government plays a significant role in funding basic research, performed largely by US universities, and then businesses play a larger role in experimental development and then commercialization of new innovations.

The United States' system of innovation has driven America's economic growth and global leadership since the middle of the 20th century. Today, the US remains a leader in creating new innovations (as measured through patents[2]), and in bringing them to scale through the country's deep, liquid capital markets (as measured in public stock listings[3]). But there is also evidence that in recent years, new technological developments require greater research inputs and the link between these innovations and economic growth has weakened – related in part to contemporaneous shifts in innovation over the past several decades (1) away from the manufacturing sector and towards information services and (2) from older, larger businesses to smaller and younger firms.

This piece first lays out how the US innovation process operates today and then proposes three broad strategies to improve America's innovation ecosystem: creating a wider array of institutions where scientific research is funded and performed, smoothing the process of commercializing new innovations, working to create more innovation clusters across the country, and fostering the development and commercialization of innovations in critical industries that exhibit large spillover effects across the economy and where productivity is lagging.

---

[2] In 2021, the US accounted for 21 percent of the world's patent applications, second only to China (25 percent) (EU 2025).

[3] See Fact 3.

The US Innovation Pipeline Today

1. The federal government funds basic research, while the business sector largely funds commercial development of new ideas

The underlying structure of research and development (R&D) in the United States follows three stages, each with different goals and different levels of risks: basic research, applied research, and experimental development. **Basic research** is aimed at uncovering new understanding of phenomena, without any specific application in mind (such as the properties of materials). **Applied research** takes such findings and directs them toward a specific use (for instance, using that knowledge to design a material with specific properties, such as durability). Finally, **experimental development** aims to use this knowledge to produce or improve new products or processes (using that material to create more durable plastic packaging) (NCES 2025a).

In 2023, the public, private and non-profit sectors directly spent $138.2 billion in R&D in the United States, with the federal government contributing an additional $19.8 billion in tax incentives meant to spur private spending on R&D (NCES 2025b, JCT 2023). Figure 1a charts the contribution of each sector (businesses, federal government, higher education, and other groups) to direct R&D spending.

Overall, businesses are the largest funder of R&D, spending 75 cents of each total dollar, with the federal government funding 18 cents. The picture looks different at each stage of the R&D process, however. The federal government is the primary funder of basic research (41%), while businesses fund 35% of research at that stage. Businesses, however, take up an larger share of R&D as the process continues, and the riskiness of the research drops, funding 62% of applied research and 88% of experimental development.

Figure 1b displays the composition of *performance* of R&D at each stage – that is, what party conducts the research. While the federal government funds a large share of research, it is a relatively smaller performer (accounting for 18% of all R&D). Instead, US colleges and universities play a significant role in the performance of R&D, particularly in basic research: 47% of all basic research was performed by higher education institutions in 2023.

Figure 1a: Composition of R&D Funding by Stage, 2023

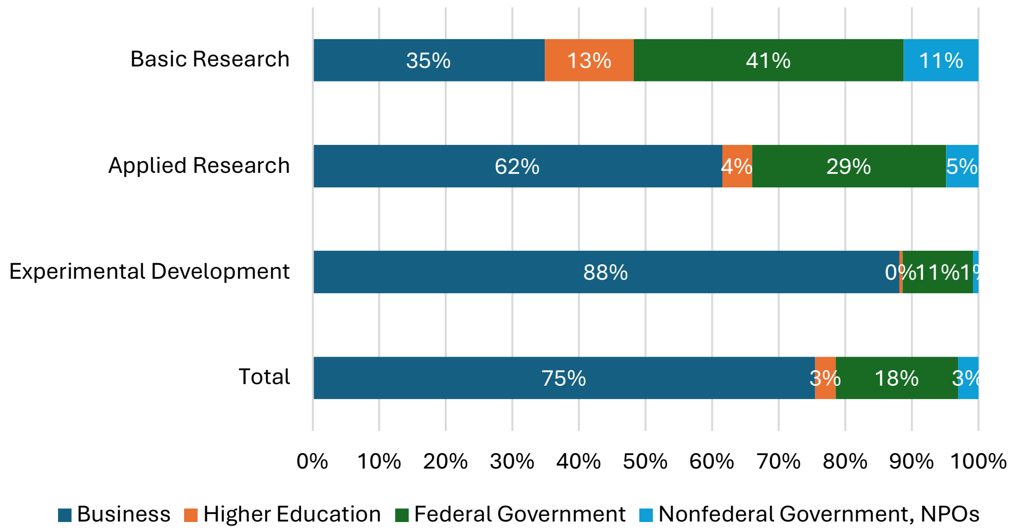
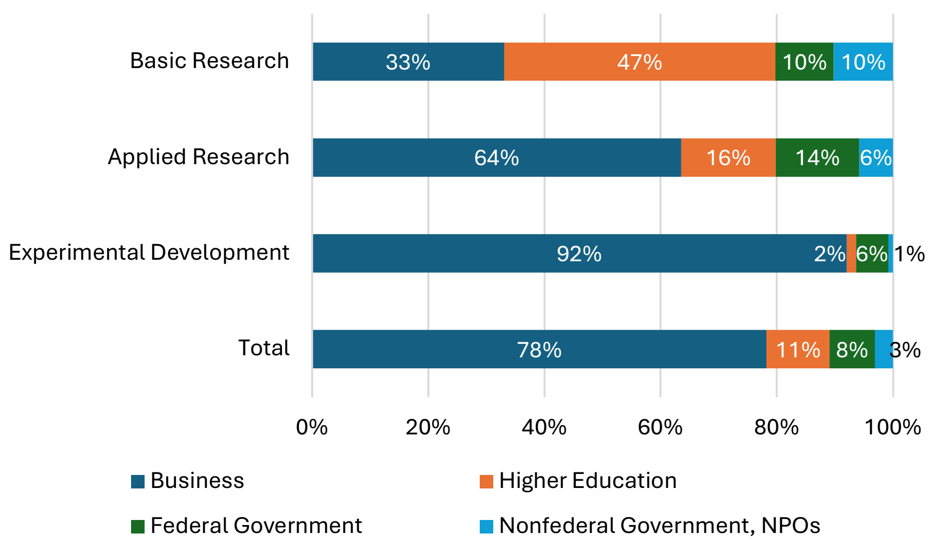


Figure 1b: Composition of R&D Performance by Stage, 2023



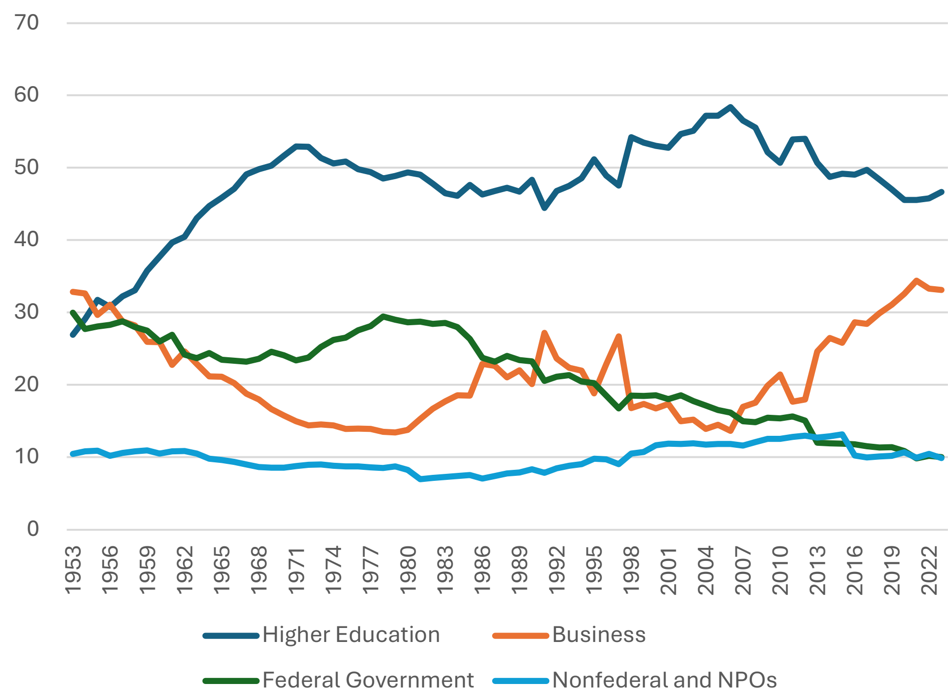
Note: NPOs are non-profit organizations.
Source: National Center for Science and Engineering Statistics (2025b)

2. America's higher education institutions have been the largest performer of R&D since the middle of the 20th century

The US innovation ecosystem was largely molded in the years during and then immediately following World War II, when the United States and the Soviet Union were vying for global leadership. In his 1945 treatise, *Science, the Endless Frontier*, Vannevar Bush, the director of the US Office of Scientific Research and Development, outlined a vision for science funding that included this tri-partite relationship between businesses, higher education, and the federal government. In particular, he advocated for the importance of public funding for basic research and the primary role America's universities would play in performing that research, resulting in the system seen in the US today.

As plotted in Figure 2, the share of basic research in the US performed by higher education institutions rose from 27 percent to 53 percent. The share has remained within a range of 44 to 57 percent over the past 50 years. As noted above, in 2023, 47 percent of all basic research is performed by higher education. It is worth noting, however, that private businesses are taking a more prominent role in the performance of basic research, driven both by rising private investment in basic research and the plateauing of federal investments in basic research (NCSE 2025a).

Figure 2: Composition of Basic Research Performance by Sector, 1953-2023

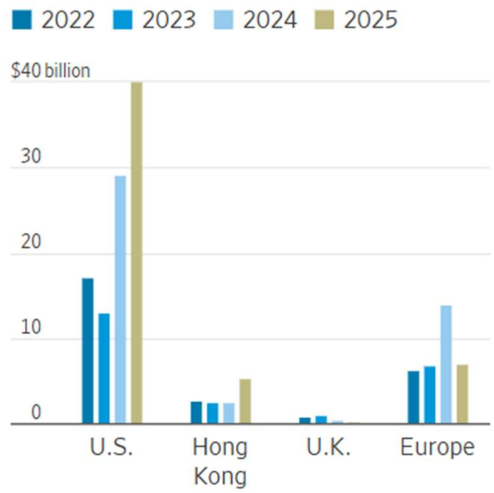


Source: National Center for Science and Engineering Statistics (2025b)

3. The innovation ecosystem is bolstered by America's deep, liquid capital markets

On the other end of the innovation pipeline, the US also has deep, liquid capital markets that provide the financial resources to bring new technologies to scale. Indeed, the gap between the US and other regions has widened in recent years. Looking at Initial Public Offering (IPO) listings, through August 14, 2025, funds raised through IPOs in the US this year grew 38 percent to $40 billion, while they halved in Europe (to around $7 billion).

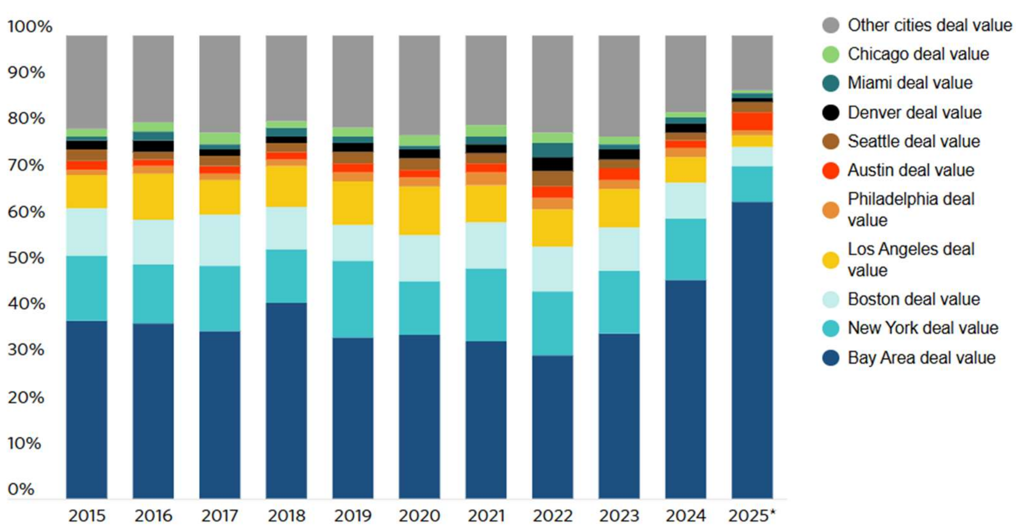
Figure 3: IPO listing, by deal location



Source: Dulaney and Wallace (2025)

Despite this continued leadership of US capital markets, private funding within the country is becoming increasingly concentrated among a select number of firms and within specific geographies. Looking at venture capital (VC) financing, just 10 transactions in the first quarter of 2025 accounted for 61 percent of total VC activity (Pitchbook 2025a). This bifurcation in funding markets has appeared geographically as well. As shown in Figure 4, three large "innovation clusters" in the San Francisco Bay Area, New York, and Boston have accounted for over 50 percent of all US VC deals over the past decade. But in the first quarter of 2025, these three clusters accounted for 72 percent of VC deal value (Pitchbook 2025b).

Figure 4: VC deal value by metropolitan area



Source: Pitchbook (2025b).

4. In recent years, the relationship between innovation and economic growth has declined

This pipeline of innovation, from basic research to experimental development to commercialization of new ideas, is important in part because it results in greater economic growth and higher living standards. As the US and other advanced countries experienced a prolonged period of slow economic growth, a group of researchers hypothesized that it was because the new, innovative ideas that can drive growth were becoming harder to find (Bloom et al. 2020). They document that, across a range of sectors, it has become increasingly resource-intensive to generate impactful new innovations. Looking at semiconductor manufacturing, for instance, they estimate that the number of researchers required to double the number of transistors on a chip in 2020 was more than 18 times larger than what was required in the early 1970s. Indeed, they find this decline in research productivity across a range of industries: agricultural research productivity for seed yields has declined at a rate of 5 percent per year and manufacturing research productivity has declined at 8 percent per year.

5. It is not clear *why* the pace of progress has declined

This trend represents a concerning disruption in the transmission mechanism of new ideas to real-world impact. But it is not clear where in this pipeline the interruption has appeared: it could be the case that new ideas are truly "harder to find," that it takes more resources today to produce an innovation equivalent to the those in the past, or it could be that the mechanism through which new innovations get to market has weakened.

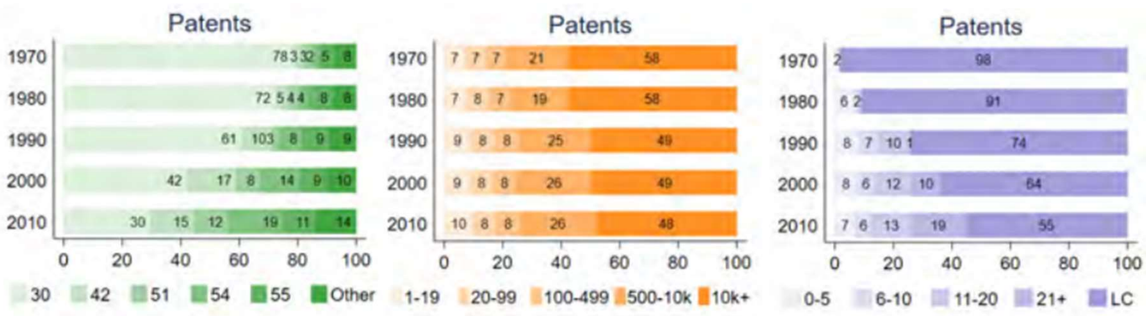
Fort et al (2025) find evidence for the second explanation: that the impact of new ideas on growth has fallen in recent years. They posit that this outcome is a result of three changes in the innovation landscape: compared to prior decades, innovation in the US economy has moved away from manufacturing firms, and it has moved to both younger and smaller firms.

As shown in Figure 3, the authors find that in 1970 US manufacturing firms dominated patenting in 1970, with the sector accounting for 78 percent of all patents. By 2000, that share had dropped to 42 percent, and by 2010 it had fallen further to 30 percent. Over that same time, the share of patents at firms with fewer than 19 employees rose from 7 to 10 percent, and at firms under five years old rose from 2 to 7 percent.

These shifts have several important implications for the relationship between innovation and productivity growth. First, the decline in innovation within the manufacturing sector is worth highlighting. In 1977, manufacturing firms accounted for 99 percent of US R&D expenditures, and by 2016 that share had fallen to 59 percent (Fort et al 2020). Manufacturing historically has exhibited large technological spillovers, by which innovations are adopted across firms and across sectors (Bloom et al 2013), so this decline in innovation among manufacturing firms may have ripple effects throughout the economy (Atalay et al 2025).[4]

Finally, the shift in innovation away from larger, older firms to smaller and younger firms may mean that these firms are less equipped (thought financial and physical capital, along with entrepreneurial know-how) to scale innovative new technologies.

Figure 5: Share of patents, by firm sector, size, and age



Firm Sector Firm Size Firm Age

Source: Fort et al. 2025

Putting it All Together: Bolstering US Innovation Policy

What steps can strengthen the pace of technological progress that has historically driven rising productivity and living standards? I highlight here four solutions to bolster US innovation:

1. Diversify models and sources of innovation funding

As described above, in the system established after World War II, R&D largely takes place either at private businesses or at universities, with funding from the federal government (in the form of grants through agencies including the National Institutes of Health, the National Science Foundation, Departments of Defense and Energy, and others).

To be sure, this system drove US economic and technological leadership through the second half of the 20th century. Perhaps the most successful model of innovation in the US has been DARPA, the Defense Advanced Research Projects Agency. DARPA is a research unit within the Department of Defense, made up of program managers who fund researchers to tackle a risky project with a long-term horizon as a coordinated team. DARPA programs have resulted in truly transformative innovations, from the first semiconductors to the beginnings of the internet to GPS. This model became celebrated enough to be replicated at other agencies, such as IARPA

[4] Interestingly (and perhaps encouragingly), there are signs of a growing recognition within the public sector of the value of innovation in the manufacturing sector: the widely-respected accelerator Y Combinator's has actively sought new startup ideas in space, defense, and manufacturing and the venture capital firm Andreesen Horowitz opened an "American Dynamism" practice that includes aims such as "Rebuilding America's Industrial Backbone" (Alamalhodaei 2024, Andreesen Horowitz 2024).

(Intelligence ARPA), ARPA-E (Advanced Research Projects Agency-Energy), and ARPA-H (Health), with varying results this far.

Part of what made DARPA effective was how unique it was: it could operate outside the bounds of government hiring rules and procedures, it encountered limited oversight even within the Department of Defense, and it has a very flat organizational structure (Reinhardt 2020). As other public programs struggle to replicate DARPA, several promising ongoing efforts at forming privately-funded ARPAs, which deserve attention. Speculative Technologies, for instance, funds a series of coordinated research programs. Moreover, Brains and BITS (Big if True Science) Accelerators offer philanthropically-funded programs to train researchers to lead coordinated research programs as DARPA's program directors did[5]. The effectiveness of such programs is too early to judge, and non-profit organizations still fund just 9% of all basic research, but such programs might serve as promising incubators of research that is not a fit for an academic lab but still too risky for private companies to fund.

Just as efforts to form private ARPA-style units have appeared, we've also seen new attempts to disrupt the traditional research funding process. For instance, during the COVID-19 pandemic, a group of individuals including Tyler Cowen, Patrick Collison, and Patrick Hsu stood up Fast Grants, a charity that funded COVID-related research. That funding might eventually have come from NSF or NIH, but this group realized that public institutions were not set up to deliver progress on the pace needed (Collison et al 2020). Again, this experience serves as an example of a time when private philanthropic funds can step in to widen the aperture of who performs innovative research.

2. Provide a stronger launchpad for innovative start-ups to access capital

Widening the scope of which groups fund and perform R&D is important, but it is also important to make existing models of innovation funding more effective. One such area where improvement can be made is in public support for scaling new innovations. Indeed, potentially innovative technology startups often end in the "valley of death," which is the time after researchers have developed an innovative new idea but before they have created a commercially viable product. At this stage, the new technology might be too far along for research funding, yet still too risky to compete for funding from venture capital firms, for instance.

The Small Business Innovation Research Program (SBIR) was created to bridge this gap. Each federal agency funding outside research is required to devote a portion of its R&D budget to SBIR programs. These programs are competitive grants awarded to small businesses in two phases: in the first phase, the company uses funding to demonstrate the feasibility and commercial potential of the innovation; once that phase is satisfied, the firm can apply for Phase II funding, in which they continue the R&D started in the first phase to develop a prototype.

---

[5] See, for instance, https://bits.renaissancephilanthropy.org/ and https://spec.tech/brains

Firms "graduate" from the SBIR program when they move from Phase II funding to receiving contracts from the supporting agency's general budget.

The SBIR program has demonstrated effectiveness: the DOD research looking at participants in the Department of Energy's SBIR program found that receipt of a phase I grant doubled the likelihood that firms received subsequent VC funding (Howell 2017); the Department of Defense SBIR program graduated technological powerhouses like Qualcomm and Anduril. Yet many small businesses that remain in Phase II, receiving government grants rather than commercializing technology, for a long period of time, and the structure of SBIR could be reformed to make sure it is serving as a launchpad for innovative firms to grow. Schonander (2025) found that 16 of the top 25 Department of Defense SBIR recipients had at least half of their contracting revenue come from SBIR awards (rather than, say, regular contracts). In 2022, Congress attempted to reign in "multiple award winners" through commercialization benchmarks, but the Government Accountability Office found that these new rules had limited impact (GAO 2024). Congress should take further steps to ensure that the SBIR remains a launching pad for innovative startups, rather than a source of perpetual funding for small businesses.

3. Foster emergence of new "innovation clusters" that drive growth

Research and innovation happens across the country, but as Figure 4 above demonstrates, geographically concentrated "innovation clusters," where much venture funding is concentrated, are a particularly important element of the growth process. Innovation clusters are networks of higher education institutions, startups, large companies, and venture capital firms located in close proximity (i.e. in the same city). The physical proximity of each of these actors creates spillover effects that drive research productivity and enhance the translation of that research into commercially viable products.

Mario Draghi, in his landmark report on European productivity, advocated for the emergence of new science and technology clusters in Europe as a path to renewed global competitiveness (EU 2025). "Successful science and technology clusters," he writes "require robust academic institutions, building communities of inventors, a skilled labor force, and well-funded financiers endowed with the expertise required to identify potentially worthy start-ups and scale-ups" (EU 2025).

Two points are worth highlighting as particularly important elements of innovation ecosystems. First, higher education institutions are a key component of these clusters. Top colleges and universities not only produce research that drives innovation, but they develop the skilled workers that startups need to succeed. It's not a coincidence that America's largest clusters – San Francisco, New York, and Boston – are also locations of elite universities. Beyond these superstar cities, the importance of high-quality educational institutions is clear: Timothy Bartik (2020) looks at case studies of several cities that underwent a dramatic renewal of growth – such as Pittsburgh and the Lehigh Valley – and in each case he highlighted the role of institutions from community colleges to large universities in fostering an innovative ecosystem.

Second, while such clusters are sustained through a self-perpetuating cycle of innovation, investment, and growth, private and public institutions can work together to reduce frictions that might prevent such a cycle from beginning. These efforts often take the form of "innovation hubs" that play a coordinating role in the innovation process. By making investments in physical space that bring researchers, entrepreneurs, and investors together, leaders can help build the communities that are essential to the innovation process – fostering the transfer of technical expertise and entrepreneurial knowledge. Moreover, these hubs often provide access to resources for testing and prototyping new technologies; by making these investments, they reduce the high fixed costs that firms, particularly in "hard tech" industries, are faced early in the commercialization process.

4. **Elicit the development of innovations in key sectors with large spillovers and where productivity is currently falling.**

It is important to keep investments in innovation, particularly in basic research and development, broad, if only because the practical applications of such research are inherently uncertain. But, as described in an early piece, the US is experiencing a declining productivity in sectors that play an important role in the US economy – both to the smooth operation of the domestic economy and to our global security and competitiveness. Indeed, the decline of innovation within the manufacturing sector described above has been tied to the offshoring of manufacturing capacity and the decay of the US industrial base that current policy efforts are attempting to reverse (Fort et al 2020). There is thus a clear rationale for public investments in the development and commercialization of innovations within such industries – including manufacturing, construction, transportation and energy distribution.

For instance, within the construction and the transportation sectors, the government could contribute to the development of new technology by funding this testing for new materials, as described in a forthcoming companion piece by Brian Potter. Within manufacturing, new research has shown the adoption of current AI technologies, while requiring upfront investments, can boost long-term productivity and growth (Brynjolfsson et al 2025). Continued public support of research into new processes and technologies of, for instance, industrial robots, is key to boosting productivity and regaining competitiveness in this sector. Finally, within the energy sector, the government can advance productivity-enhancing innovations by supporting long-term, risky investments in new technologies through tools like Advance Purchase Commitments, under which the government commits to buying a product from a firm that is able to develop it. Such tools have been proposed to hasten the development of long-term energy storage technologies. In creating a guaranteed market for such goods, the government provides certainty to private-sector actors to make large, fixed investments in innovations whose social value outstrips the return they might receive in the private market.

Conclusion

America's high living standards and global leadership are in large part the result of productivity-enhancing innovations that did not emerge out of thin air, but rather from large investments and hard work of researchers and entrepreneurs within a system carefully designed to push technological progress forward. Yet, there are concerning signs that this pace of progress has slowed – that the link between our inputs to innovation and their impact on economic growth has weakened. By looking to new, innovative forms of research institutions, by strengthening the links between innovations and commercialization, and by fostering more clusters that create self-sustaining growth cycles, the triangular partnership of private sector actors, higher education institutions, and the federal government can get growth back on track. This system drove America's global leadership in the 20^{th} century; at a time when the race for economic and military primacy appears to be back on, doing so is more important than ever.

References

Alamalhodaei, Aria. 2024. "The hard tech renaissance accelerates as YC spotlights space, manufacturing and defense." *TechCrunch*. Accessed 11 September 2025. https://techcrunch.com/2024/02/16/the-hard-tech-renaissance-accelerates-as-yc-spotlights-space-manufacturing-and-defense/

Atalay, Enghin, Ali Hortascu, Nicole Kimmel, Chad Syverson. 2025. "Why Is Manufacturing Productivity Growth So Low?" Working Paper. Accessed 9 September 2025. https://enghinatalay.github.io/manufacturing.pdf

Bloom, Nicholas, March Schankerman, John Van Reenen/ 2007. "Identifying Technology Spillovers and Product Market Rivalry." NBER Working Paper 13060. https://www.nber.org/system/files/working_papers/w13060/w13060.pdf

Bloom, Nicholas, Charles I. Jones, John Van Reenen, Michael Webb. 2020. "Are Ideas Getting Harder to Find?" *American Economic Review*. 110(4):1104-1144.

Collison, Patrick, Tyler Cowen, and Patrick Hsu. 2020. "What We Learned Doing Fast Grants." *Fast Company*. Accessed 10 September 2025. https://future.com/what-we-learned-doing-fast-grants/

Dulaney, Chelsea and Joe Wallace. 2025. "America's Stock-Market Dominance Is an Emergency for Europe." *Wall Street Journal*. Accessed 11 September 2025. https://www.wsj.com/finance/investing/americas-stock-market-dominance-is-an-emergency-for-europe/

Fort, Teresa, Nathan Goldschlag, Jack Liang, Peter K. Schott, Nikolas Zolas. 2025. "Growth is Getting Harder to Find, Not Ideas." Census Bureau CES Working Paper 25-21. https://www2.census.gov/library/working-papers/2025/adrm/ces/CES-WP-25-21.pdf

Fort, Teresa C., Wolfgang Keller, Peter K. Schott, Stephen Yeaple, Nikolas Zolas. 2020. "Colocation of Production and Innovation: Evidence from the United States." Working Paper. https://faculty.tuck.dartmouth.edu/images/uploads/faculty/teresa-fort/FKSYZ_colocation_dec20.pdf

Government Accountability Office. 2024. "Small Business Research Programs: Increased Performance Standards Likely Affect Few Businesses Receiving Multiple Awards." Accessed 10 September 2025. https://www.gao.gov/products/gao-24-106398

Joint Committee on Taxation. 2023. "Estimates Of Federal Tax Expenditures For Fiscal Years 2023-2027." https://www.jct.gov/publications/2023/jcx-59-23/

McElheran, Kristina, Mu-Jeung Yang, Zachary Kroff, Erik Brynjolfsson. 2025. "The Rise of Industrial AI in America: Microfoundations of the Productivity J-curve(s)." Census

Bureau CES Working Paper 25-27. https://www2.census.gov/library/working-papers/2025/adrm/ces/CES-WP-25-27.pdf

National Center for Science and Engineering Statistics. 2025a. “National Patterns of R&D Resources.” Accessed 11 September 2025. https://ncses.nsf.gov/data-collections/national-patterns/2022-2023

National Center for Science and Engineering Statistics. NCES 2025b. “Academic R&D in the U.S. R&D Enterprise” Accessed 11 September 2025. https://ncses.nsf.gov/pubs/nsb202326/academic-r-d-in-the-u-s-r-d-enterprise

PitchBook. 2025a. “PitchBook-NVCA Venture Monitor: Q1 2025.” https://pitchbook.com/news/reports/q1-2025-pitchbook-nvca-venture-monitor

PitchBook 2025b. “Map: The geography of US venture deals in Q1 2025.” https://pitchbook.com/news/articles/map-us-regional-venture-capital-deals-q1-2025

Power, Chris, Oliver Hsu, Jordan Black, and Bryon Hargis. 2024. “Rebuilding America’s Industrial Backbone.” *Andreesen Horowitz a16z Podcast*. https://a16z.com/podcast/rebuilding-americas-industrial-backbone/

Schönander, Lars Erik. 2025. “Recommendations for the Small Business Innovation Research Program.” Foundation for American Innovation. Accessed 10 September 2025. https://www.thefai.org/posts/recommendations-for-the-small-business-innovation-research-program