CEO of Scale A.I. Alexandr Wang, American Enterprise Institute fellow Klon Kitchen, and Global A.I. ethicist at DataRobot Dr. Haniyeh Mahmoudian testify during a House Armed Services Subcommittee on Cyber, Information Technologies and Innovation hearing about artificial intelligence on Capitol Hill July 18, 2023, in Washington, D.C. (Drew Angerer / Getty Images)

Targeted and Precise: Innovation Versus Regulation in the Critical Technology Sector

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Introduction: The U.S. Critical Technology Ecosystem

Despite popular media portrayals of self-taught entrepreneurs developing technological marvels in rented garages, new innovations in the United States are predominantly funded and sustained through federal initiatives bolstering successful enterprises. The strengthening bond between technology giants and Washington over time is a function of the centrality of cutting-edge tech to two areas vital to the national interest in the 21st century: military-technological supremacy and economic competition with China.

For the U.S. Department of Defense, the value added by public-private cooperation is self-evident: Leadership in advanced technologies deters and provides an asymmetric advantage against U.S. adversaries, and for the past 40 years, nearly all groundbreaking innovations have originated from domestic private firms. Procuring and outsourcing cutting-edge products and services strengthens the

defense-industrial base at a fraction of the cost of equivalent public-sector projects while expanding American geopolitical influence and bolstering gross domestic product (GDP). In return, the Department of Defense serves as a "venture customer" that provides substantial funding – at substantial financial risk – for private-sector innovations before consumer demand rises to fill the gap.[1]

For the executive branch, at least in peacetime, ensuring that the United States remains a global hegemon takes primacy. After securing international dominance in manufacturing by the end of World War II, America kept its lead by localizing high-value, low-hazard activities like research and development (R&D) and outsourcing low-value, labor-intensive tasks like mining and manufacturing to countries in the Global South.[2] Prioritizing operations higher on global value chains allowed American technology firms to increase profitability without significant public investment or regulatory intervention.[3] Instead, free trade, foreign partnerships, and strategic global investments enabled the United States to surpass the technological capacities of all other countries in the system and attract new ideas and investment into its orbit.

Decades of laissez-faire oversight and unregulated capital consolidation, however, gradually whittled down America's innovation dynamism. U.S. leadership in sourcing and production slowed, driving depreciating returns in economic growth and productivity across all but a few geographic areas and specialties.[4] Ensuring local diversity of outputs beyond R&D was critical for market disruption, but the infrastructure required to support activities like manufacturing and after-sales service no longer existed domestically. As policymakers grappled with this new reality, a nation that had spent the past quarter-century testing radical industrial policies began challenging the foundational principles of the U.S. free-market system: the People's Republic of China (PRC).

By securing near-monopolies over several non-R&D activities and investing $912 billion in technology start-ups between 2013 and 2023, China gained unprecedented leverage over global technology markets.[5] Aggressive state-driven investment, mercantilist industrial policies, and exploitation of free market and innovation ecosystems soon began to drive rapid advances in artificial intelligence (AI), quantum sensors, electric batteries, and advanced manufacturing.[6] Despite Western assertions that these strategies would fail to drive indigenous research and development,[7] China soon surpassed the U.S. in several key AI metrics, including number of patents filed,[8] research papers published,[9] and public investment as a share of GDP.[10]

Despite these risks, the importance of sustaining America's technological hegemony can seem distant from the interests of the average taxpayer. Developing bleeding-edge technologies requires billions of dollars and years of sustained funding for geopolitical advantages that may never materialize. In a politically polarized nation where kitchen-table economics increasingly supersedes abstract technocratic objectives,[11] sustaining public support for broad industrial initiatives across multiple election cycles poses a significant challenge – one that single-party states like China are not constrained by.

Enter public diplomacy and political advocacy. While only four in 10 Americans believe that the People's Republic of China's technological capacity is "of very serious concern," its human rights record, support for Russia, and tensions with Taiwan represent more salient threats in the public lexicon.[12] To sustain bipartisan and public support for the policies needed to stay ahead of Beijing, Washington must frame U.S.-China strategic competition as an ideological war, with democratic values and ethics on one side and authoritarianism and territorial encroachment on the other.

While this portrayal is conceptual, the underlying risks are real. By funneling innovations from its private sector and foreign collaborators into its military apparatus, the Chinese Communist Party aims to "intelligentize" its People's Liberation Army (PLA) and supersede the United States in next-generation warfare by 2035.[13] The Australian Strategic Policy Institute finds that while U.S. firms dominate in commercial AI sales, China's leadership in 24 technologies with a high risk of monopoly includes every single one with defense applications.[14] If China's autonomous drone systems, cyber warfare tools, and advanced missile technologies surpass U.S. capabilities, it could not

only undermine American technological leadership but also shift the global balance of power and sideline the liberal, rules-based order that has long underpinned U.S. foreign policy. For this reason, preventing innovation stagnation is not a hypothetical or distant concern – it is a direct threat to U.S. national security, economic stability, and global influence, and as such requires unprecedented government intervention.

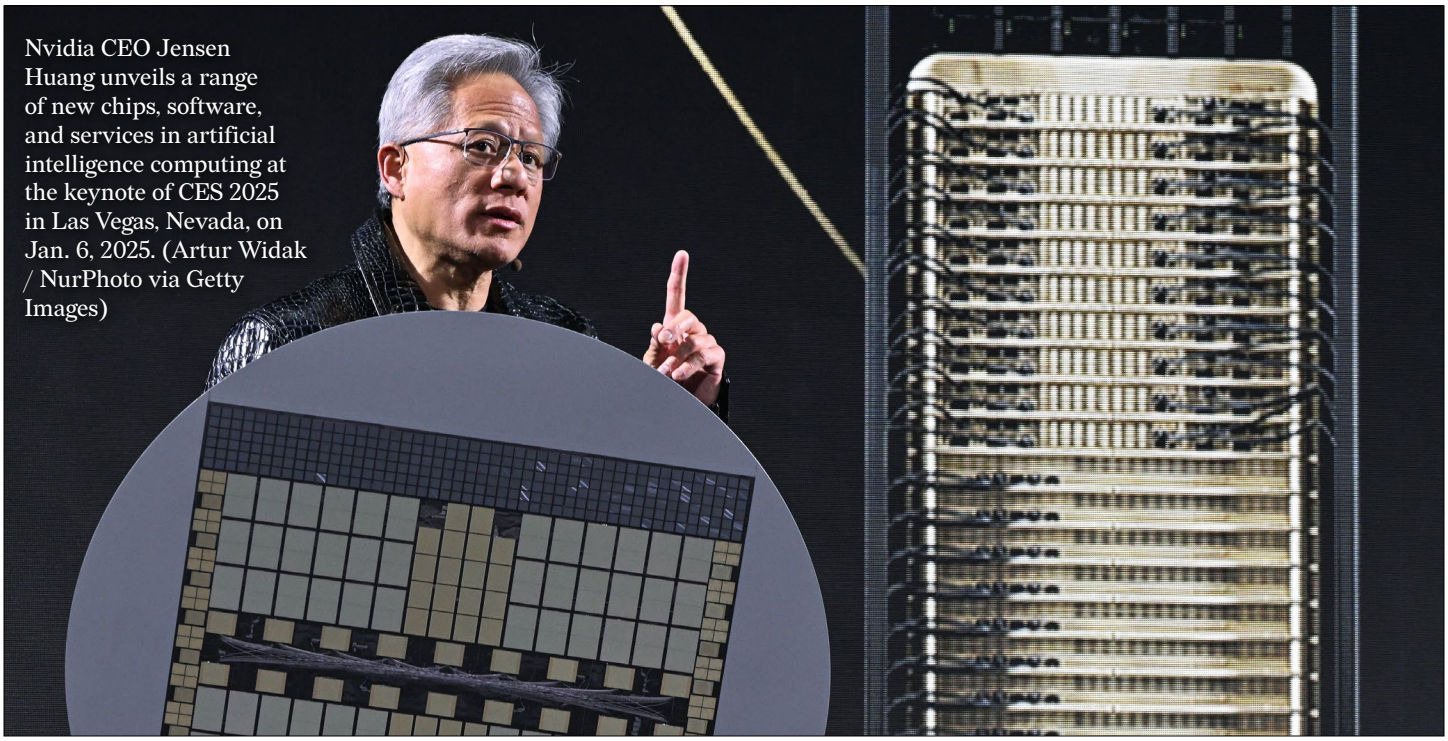
Industrial Policy Goals and Mechanisms

U.S. critical technology initiatives may not inhibit China's economic development, alter its territorial claims, or mitigate its authoritarianism, but within an economic competitiveness framework, none are necessary to "beat China." Rather, the U.S. "winning" the global technology race comprises gaining dominance over a range of strategic investments that pay dividends in both conflict and peacetime, and then using those investments for public good at home and to promote U.S. influence abroad. The more resources that are applied to this effort (and to building strong coalitions that multiply gains and protect shared spoils), the more China is deterred from future geopolitical malfeasance and incentivized to follow the rules-based liberal order.

Within this strategic competition framework, a successful industrial policy strategy for critical technology development (1) maximizes national return on investment, (2) aligns the ensuing benefits with the public interest, (3) mitigates the risk of exploitation by adversaries, and (4) furthers U.S. foreign policy goals. Legislators must ensure these needs are met while providing sufficient incentives for firms to cooperate with – and even promote – regulations that affect their bottom line.

Allocation and Coordination of National Resources

The first priority for U.S. industrial policy is to maximize national return on investment, either directly through revenue generation or indirectly through benefits to society and national security. Corporate taxes on the technology sector redistribute the disproportionately high financial returns of a small group of innovators across broad spending buckets like health care, infrastructure, and education. Targeted fiscal mechanisms – such as subsidies, public-private partnerships, and tax incentives – reinvest those revenues back into the innovation ecosystem.[15]



Nvidia CEO Jensen Huang unveils a range of new chips, software, and services in artificial intelligence computing at the keynote of CES 2025 in Las Vegas, Nevada, on Jan. 6, 2025. (Artur Widak / NurPhoto via Getty Images)

American corporate tax rates are substantially lower than in other developed countries, bringing in less revenue as a share of GDP than nearly all other market-based economies.[16] As a result, the United States spends less on R&D as a percentage of its GDP than Israel and South Korea.[17] In 2024, the Biden administration budgeted $209 billion for public science and technology programs,[18] including $102 billion for health and social equity initiatives.[19] China currently spends about five times more on its supply-side investments,[20] funneling more than $912 billion into critical technology startups alone over the past 10 years.[21] However, substantial tax credits and subsidies make private sector R&D more lucrative in the United States than in China. As Washington's spending on R&D as a function of GDP has declined,[22] total U.S. investment in research and development has increased exponentially, with corporate spending now comprising nearly 80% of the U.S. total.[23]

Private sector R&D expenditures result in more cost-effective and market-oriented innovations than are typically produced by the public sector. However, capital investment alone does not inherently drive output of new technologies.[24] Functional constraints, including specialized labor, raw materials, machinery, and research time, become more burdensome as demand for cutting-edge tech expands. The critical technology sector must also make investments to protect its proprietary technology, data, and supply chains from extortion and theft.[25] Well-resourced firms that are unable or unwilling to address these systemic challenges tend to redirect new capital into areas with fewer constraints, such as stock buybacks and executive salaries.[26] The resulting rentiership and bureaucratic bloat drive diminishing returns that weaken return on investment as additional resources are injected.

For this reason, Washington must invest not only in individual firms but also in the foundational infrastructure underpinning the critical technology sector. Energy grids, data networks, and transportation lines must be robust for emerging technology initiatives to be effective.[27] Over time, the responsibilities of labor provision, job training, and benefits like retirement and health insurance have also shifted from the private to the public sector due to the former's exponential growth model and the latter's accelerating demand for dual-use technologies.[28] In semiconductor manufacturing, for instance, federal and state job training programs allow firms to improve total factor productivity by increasing their hiring requirements rather than provide on-the-job instruction, though the Semiconductor Industry Association projects that 58% of new jobs will go unfilled by 2030 without significant program expansion.[29, 30]

As federal responsibilities expand, investments in coordination, administration, and oversight must rise in tandem. Starting with President Donald Trump's "Executive Order on Maintaining American Leadership in Artificial Intelligence" in 2019,[31] executive orders became the primary vehicle to authorize new administrative capacity. Subsequent orders reformed the Cybersecurity and Infrastructure Security Agency and bolstered existing export mechanisms such as the Bureau of Industry and Security (BIS), Committee on Foreign Investment in the United States (CFIUS), and Office of Foreign Assets Control (OFAC). President Joe Biden continued his predecessor's focus on strategic technologies but emphasized multisector applications such as infrastructure, health, and social equity. Biden signed into law the Infrastructure Investment and Jobs Act, the Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act, and the Inflation Reduction Act. These new and expanded vehicles oversee more than 160 new R&D programs with more than $730 billion in funding.[32] Finally, National Defense Authorization Acts allow Congress to regulate innovation, with the 2021 law establishing the National Artificial Intelligence Initiative Office and the 2023 law banning Chinese semiconductors from government contractor supply chains.[33, 34]

Domestic Regulations and Award Conditions

Improved access to infrastructure, labor, and capital lowers the cost of entry for new players in the advanced technology space, increasing innovation dynamism and GDP. However, net benefits to the U.S. economy do not always represent net benefits to the average American. The cultural communication supporting these enormous investments is undermined if Washington's priorities are unable to be sufficiently differentiated from those of the Chinese Communist Party or other unsavory regimes. If U.S. citizens feel unjustly surveilled, overtaxed, underpaid,

or politically disenfranchised due to federally funded advancements in emerging technologies, public support for these initiatives will decline. For the government , this means losing not only the potential economic benefits of an innovation but also the geopolitical and military advantages it provides.

Legislation, regulations, and grant terms ensure that Washington's critical technology investments reflect American ethics and values. Principles like social equity, privacy, human rights, and democracy are not inherent to free markets; on the contrary, when left unchecked, emerging technologies tend to serve the interests of capital-rich investors over unmet social needs.[35] Executive orders and memorandums, like the Biden administration's Policy to Advance Governance, Innovation, and Risk Management in Federal Agencies' Use of AI, aim to predict and prevent negative externalities that could arise from new technology investments.[36] Program regulations and grant agreements, like the CHIPS and Science Act's requirement that firms seeking $150 million in funding provide childcare plans for their blue-collar workforce, ensure that taxpayer-funded programs contribute to the public good.[37]

Trade and Export Controls

Export, investment, and trade controls aim to prevent bad actors from unduly exploiting America's innovations and international collaborations, gain an asymmetric advantage over the state, or pose threats to U.S. national security. Trade policy determines what products, services, and end users are of particular importance to U.S. global leadership and defense, while Export Administration Regulations (EARs) ensure that these assets are protected from exploitation and capture by foreign adversaries.

The primary authorizing statutes for export controls are the Arms Export Control Act, the Export Control Reform Act, and the International Emergency Economic Powers Act. With executive branch coordination from the Office of the U.S. Trade Representative,[38] oversight and enforcement of U.S. export controls are dispersed across several government agencies. If a foreign entity is deemed to threaten U.S. national security, OFAC and BIS place it on one or more end-user sanctions lists with varying degrees of restrictions.[39] Export controls for all commercial items – as well as many dual-use

Key fobs are produced at a manufacturing plant in Tlajomulco de Zuniga, Jalisco State, Mexico, on Feb. 20, 2025. (Ulises Ruiz / AFP via Getty Images)

technologies such as semiconductors, AI, and quantum computers – are also enforced by BIS.[40] Export controls for conventional weapons and other dual-use technologies, meanwhile, are directed by the State Department's Conventional Arms Threat Reduction Office.[41] The International Traffic in Arms Regulations, a section of the Arms Export Control Act, grants the State Department's Directorate of Defense Trade Controls jurisdiction over munitions and defense articles and services not covered by other entities.[42]

While export controls help ensure that U.S. products and services are unable to reach America's adversaries, import controls like taxes, tariffs, and duties are used to offset injurious trade practices and gain leverage in international negotiations. The president is granted broad authority by Congress to impose tariffs and duties on imports that threaten U.S. security or the national interest.[43] The secretary of the treasury then interprets these orders and drafts regulations to be enforced by U.S. Customs and Border Protection at U.S. ports of entry.

A final set of policies ensure that nonsensitive products and services are diffused fairly throughout the international environment. Section 301 of the U.S. Trade Act authorizes the president to impose tariffs and other trade restrictions on countries that unduly burden or restrict free trade, regardless of their membership in the World Trade Organization (WTO).[44] This authority gained prominence in 2018, when Trump imposed a series of tariffs to pressure the Chinese government to rescind its policies and practices related to technology transfer and intellectual property theft.[45] Before this, these activities faced few unilateral repercussions from other countries, with WTO cases and patent infringement lawsuits providing the primary mechanisms for dispute resolution. Afterward, several nations – including non-European countries like India and Vietnam – followed the United States' lead in imposing tariffs on China's technology industries.[46]

Foreign Investment and Transaction Controls

In addition to ensuring that its exports do not increase risks to national security, the United States aims to monitor and prevent innovations deemed "critical" or "dual use" from being acquired or invested in by its competitors and adversaries. In 1975, President Gerald Ford's Executive Order 11858 established CFIUS to prevent foreign firms from capturing the uppermost benefits from the U.S. critical technology and defense sector.[47] The primary statutes authorizing CFIUS are the Defense Production Act of 1950, the Foreign Investment Risk Review Modernization Act of 2018, and the Foreign Investment and National Security Act of 2007.[48] Over time, CFIUS's oversight has expanded from reviewing foreign mergers and acquisitions of U.S. companies that are integral to defense supply chains to overseeing a wide variety of transactions, mergers, and noncontrolling investments in critical industries as well as real estate near military and maritime installations.

Inverse mechanisms prevent U.S. firms from investing in or acquiring foreign assets that might be used against the country or its sensitive industries. While U.S. partners such as Japan, Taiwan, and South Korea have long maintained restrictions on outbound investment in foreign dual-use technologies, U.S. tech firms have had broad agency to partner with foreign entities on advanced research centers, fabrication plants, and joint ventures. While CFIUS is not authorized to oversee these transactions, mechanisms have recently been instituted to monitor and prevent PRC military and intelligence agencies from benefiting from them.[49] These include the CHIPS and Science Act's requirement that grantees not expand manufacturing in China for at least 10 years and the U.S. Outbound Investment Security Program's prohibition of outbound investments in a number of Chinese industries.[50] This departure from traditional U.S. policy aims to be limited in scope to only specified products and firms associated with PRC military and intelligence activities. However, Beijing's expansive civil-military fusion regime and Washington's decentralized and overlapping regulatory structure make enforcement of these policies extraordinarily difficult, particularly when they require investigations of foreign subsidiaries and intermediaries in addition to U.S. investments and transactions.

Finally, domestic regulations on trade and investment are used to promote cosmopolitan foreign policy objectives, such as reducing forced labor and corruption abroad. BIS is broadly required to consider human rights concerns when reviewing trade license applications, and it must reject specific products and

services when directed by the president and other authorities under part 766 of the EAR.[51] For example, BIS is required to deny export licensing for products and services used by the PRC for crime control and surveillance in Hong Kong.[52] Additionally, statutes such as the Uyghur Forced Labor Prevention Act[53] and Global Magnitsky Act[54] prevent U.S. entities from engaging in trade with foreign entities responsible for gross violations of internationally recognized human rights. As with part 766 orders, these prohibited end users and products of concern must first be stipulated by the president or another specified authority.

Cooperative Agreements and Regimes

The final objective of U.S. economic competition policy is to create foreign initiatives that sustain U.S. global leadership and influence. The most significant multilateral regimes regulate global proliferation of weapons of mass destruction and "destabilizing accumulations" of conventional weapons and dual-use technologies: the Wassenaar Arrangement, Nuclear Suppliers Group, Australia Group, and Missile Technology Control Regime.[55] The second-largest multilateral agreements are those that regulate free and fair trade. One of the most active international dispute settlement institutions in the world, the WTO, is dedicated to ensuring its signatories maintain open, fair, and undistorted economic competition policies and practices.[56] The World Bank, the United Nations Conference on Trade and Development, and the Organization for Economic Cooperation and Development also promote democratic and market economic principles; negotiations for the latter two mechanisms are overseen by the Office of the U.S. Trade Representative.

Policy considerations under trade agreements have become broader and more sophisticated over time. According to the United Nations Conference on Trade and Development, issues currently governed by regional trade agreements include environmental protection, migration, workplace safety, and intellectual property rights.[57] International mechanisms also

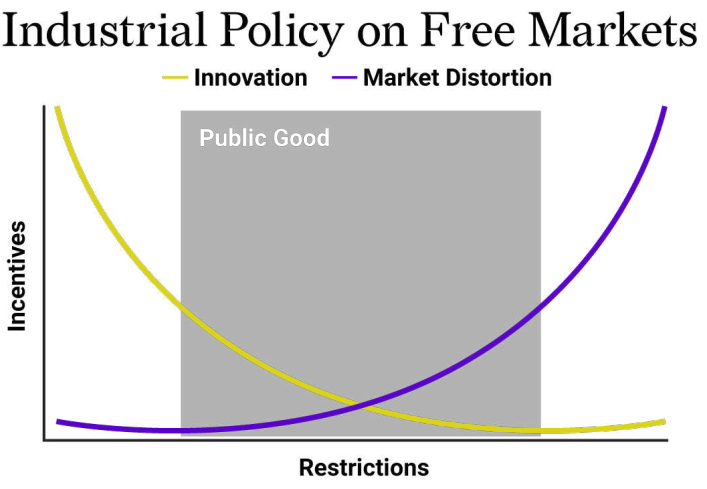
Federal Reserve Chair Jerome Powell testifies before the Senate Banking Committee about the Fed's continuing efforts to tame inflation and ease borrowing costs in the face of new tariffs, possible tax cuts, and other institutional moves by the Trump administration on Capitol Hill on Feb. 11, 2025, in Washington, D.C. (Chip Somodevilla / Getty Images)

govern trade in emerging technologies. Both the U.S.-EU Trade and Technology Council and the Export Controls and Human Rights Initiative research and publish international standards for exporting technologies that may be misused for human rights violations. Other mechanisms – such as the Indo-Pacific Economic Framework, Americas Partnership for Economic Prosperity, and International Technology Security and Innovation fund – promote resilient critical technology supply chains.[58]

Regulatory Risk in the Critical Technology Sector

In exchange for their contributions to the defense and public sectors, technology firms receive generous incentives that allow them to innovate broader and further than through private investment alone. As long as the government provides these incentives, it is able to influence which innovations are developed, where they should go, and who should use them. However, if Washington's web of policies and priorities becomes too prohibitive to navigate, firms will move elsewhere to secure ongoing shareholder returns. For this reason, industrial policy must ensure that a broad range of firms are incentivized to cooperate with the demands of federal and state agencies.

Because the U.S. is a democracy, equilibrium between the interests of firms and the government is not enough to justify large volumes of public spending. Both incentives and restrictions require public awareness and support, which is achieved by aligning initiatives with domestic priorities and ensuring sufficient tax revenue for other spending buckets. Industrial policies that infringe on free and fair trade have also traditionally required a credible national security justification to avoid unduly violating U.S. international agreements, making a minimum threshold of consent from U.S. partners and allies an unspoken requirement. However, recent shifts deprioritizing multilateralism in the executive branch have made this consideration less significant.



Source: Courtney Manning © 2025, The New Lines Institute for Strategy and Policy

The final major risk of industrial policy is market distortion. Even when incentives and restrictions are evenly balanced, industrial policies and other government interventions impose complex and unpredictable effects on the rest of the economic system.[59] For this reason, while a minimum level of regulation is needed to prevent exploitation by adversaries and rent-seeking firms, industrial policies should target only critical technologies with significant and understood military applications while maximizing agency for commercial innovators to collaborate and take risks. If not, the friction produced by colliding variables of successive waves of intervention will rapidly drive diminishing returns in innovation and technological development.

In periods of high market distortion, the technology sector is unable to efficiently meet the needs of the state and its citizens. Before the endpoint of complete isolationism or net-zero innovation, four gradually increasing negative effects provide warning signs that U.S. industrial policy is becoming too restrictive: protectionism, regulatory ambiguity, bureaucratic bloat, and escalation spirals.

Protectionism

The U.S. technology industry once cultivated a variety of economic activities, each providing continuous opportunities for innovation and market disruption. Eventually, prioritization of intellectual property creation – particularly hardware and software design – led to the offshoring of most other activities. Technology firms sacrificed long-term opportunities to innovate in processes like procurement, manufacturing, and after-sales service for immediate savings in labor costs. By 2019, intellectual property accounted for 41 percent of U.S. GDP and 44 percent of total U.S. employment,[60]

narrowing U.S. labor demand and creating high-risk supply chain dependencies.

To combat these risks, the first Trump administration proposed tariffs on manufactured goods and raw materials to reshore non-R&D activities, improve supply chain resiliency, and promote rural job creation. However, penalizing imports and foreign partnerships rarely motivates the creation of domestic replacement capacity.[61] A study by the Harvard Kennedy School determined that most U.S. companies affected by tariffs between 2018 and 2019 chose to downsize or move operations to the Indo-Pacific or Latin America rather than invest in domestic facilities.[62] Foreign partners are even more incentivized than domestic firms to move their operations elsewhere, significantly reducing U.S. tax revenue and employment.[63] Given that tariff collection accounts for only 1.57% of federal income as of 2024, federal enforcement costs and revenue losses far exceed revenue raised through new trade restrictions.[64]

While financial penalties can appear more cost effective than direct investment, the fiscal burden of policy implementation, enforcement, and oversight makes incentives more efficient in achieving short-term market change.[65] However, while initiatives like the CHIPS and Science Act can temporarily reinvigorate declining industries,[66] it is unlikely that these industries will be independently profitable without continued subsidies. Significant improvements in modernization and automation are needed to make critical technology manufacturing economically viable in the United States. Otherwise, reducing incentives or increasing subsidy requirements will lead firms to re-offshore or significantly increase product costs, causing ripple effects across upstream supply chains. This was demonstrated in 2023, when protectionist licensing restrictions and the Inflation Reduction Act's complicated subsidy restrictions led Ford Motor Company to cut investment and reduce hiring and production targets for its planned domestic battery projects.[67]

Domestic supply chain consolidation reduces economic efficiency and market diversity, slowing innovation and raising consumer prices. The PRC, which has spent decades attempting to drive rapid technological advancement with protectionism, faces significant and continuous hurdles in achieving a self-sustaining innovation ecosystem. When "foreign influence" was removed from the development process of China's COMAC C919 aircraft in 2008, the $70 billion public investment was delayed by nearly 10 years while replacement knowledge and infrastructure were built domestically. As of January 2025, the aircraft continues to fail certification and safety tests from aviation authorities outside China.[68, 69]

Finally, American isolationism encourages protectionist trade policies to spread across the international system. As tariffs rise between China and the U.S., some countries are lowering tariff rates to incentivize U.S. investment and manufacturing.[70] However, these cases are a minority, and many other countries – including Mexico, Vietnam, and South Africa – are raising duties on various links in the critical technology supply chain. Indonesia has ceased exporting some raw materials entirely, forcing foreign firms to process them onshore instead.[71] As countries with low tariffs and production costs tend to be less politically stable, investment and trade barriers between middle- and high-income partners become a prisoner's dilemma that drives investment to the bottom dollar rather than to improved supply chain security or strategic alignment.

Regulatory Ambiguity

Aligning critical technology development with the public interest requires significant accountability and oversight capacity. The broader the scope and desired impact of a given policy, the more funding is required to ensure that the policy meets its objectives. Because more complex technologies have more expansive supply chains, industrial controls in the U.S. critical technology sector must be targeted and precise to prevent regulations from becoming unwieldy, vague, and ultimately ineffective.

Broad regulations allow Beijing to demand proprietary technology and sensitive data from foreign entities in exchange for access to Chinese markets. By 2023, nearly 60% of surveyed U.S. businesses in the information technology industry stated they had considered closing or downsizing their Chinese operations due to the lack of clarity on key definitions in regulations.[72] According to a survey by the European

South Korean Foreign Minister Cho Tae-yul speaks during a press conference ahead of a U.N. Security Council meeting on the impacts of cyber threats on international peace and security at U.N. headquarters on June 20, 2024, in New York. (Yuki Iwamura / AFP via Getty Images)

Chamber of Commerce, "as the scope of 'important data' in [Chinese regulations] is yet to be defined by the National Financial Regulatory Administration, it makes it difficult for companies to determine which data must pass a security assessment [and] predict how stringent security assessment requirements will be."[73] The survey showed that European firms' decisions to downsize or reassess participation in Chinese markets primarily resulted from China's ambiguity in its policies and practices and not U.S. or EU industrial policies. The enormous profit potential of Chinese markets, however, means that years of recurring data breaches and escalating warnings from Western governments have mostly failed to slow trade and investment in China.

Unlike in China, where industrial policy mechanisms have been institutionalized for over a generation, the U.S. government was not designed to enforce broad trade restrictions and remains ill-equipped to do so.[74] Though China's regulatory ambiguity is intentional rather than the result of a decentralized regulatory structure, the result of broad trade policies in the United States is the same: reduced trade and investor confidence, and increased scrutiny from free trade partners and institutions. Some of these risks would subside if Washington was committed to comprehensively implementing and enforcing trade controls. However, because complete and nondiscriminatory enforcement of current controls would significantly undermine U.S. economic competitiveness, ambiguity is unlikely to decrease over the next four years.

Vendor Lock-In

Working with national champions in the critical technology industry provides Washington with several advantages in capacity, immediacy, and security. However, centralizing the assets and foundational resources of the emerging tech market in the hands of a few large companies risks homogenizing the foundational infrastructure underpinning the critical technology industry, making it difficult or impossible to maintain a competitive innovation landscape.

Additionally, "locking in" governments to commercial infrastructures, products, and services creates significant vulnerabilities that closed-system adversaries and competitors can exploit. When U.S. federal agencies use the same digital infrastructure as billions of global consumers, any individual or group with sufficient knowledge of that infrastructure's

weaknesses can access sensitive U.S. data and technology. Exploits in one agency's cyber defenses can grant hackers access to all other agencies in the system, magnifying potential harm. This was illustrated during the 2023 SolarWinds hack, when nearly two dozen high-profile U.S. government agencies were penetrated using the same entry procedures.[75]

Advocates of the national champions model posit that America's leading technology firms are also its leading cybersecurity firms, while smaller competitors are less capable of both providing services and protecting those services from predation. However, continuous awareness of new cyber threats and ongoing replacement of vulnerable code is extremely cost-intensive, especially for poorly maintained and aging systems that no longer bring in revenue. As a result, older and larger firms must sacrifice either profitability or security, and their obligation to shareholders often takes priority. To retain tech giants as providers, the government must pay not only for its own specialized services and security but also for the ongoing protection of the firm's substantial foreign and aging digital infrastructure. These investments can be prohibitive, but cutting costs magnifies cyber risk. In the case of the SolarWinds hack, detection and attribution were impossible because federal agencies used a cheaper software model without basic network security protections.

Several proposals have been made to force large technology firms to improve their cybersecurity practices.[76] However, the limited competition for service provision in cloud computing and other critical technology services skews the power dynamics between firms and the government, making these regulations unlikely to pass without proportionate financial assistance from Washington.[77] As a result, frameworks like the Office of Management and Budget's Federal Zero Trust Strategy place the burden of responsibility for cybersecurity on the end user and federal agencies instead of on providers.[78] While strengthening public-sector cybersecurity expertise is important, stringent government contract agreement clauses protecting tech firms' proprietary data and source code limit oversight of external mechanisms.

National champions may be inevitable when only a few large firms can meet the needs of the state, but these risks could be mitigated if the U.S. had fewer barriers to entry in its critical technology sector. Expanding the knowledge and resource base of the market requires improving access to data and source code, which form the basis for all software-based algorithms and services. Large data sets required for AI development are sold by a small number of American social media companies at high premiums – and unlike in China, the U.S. government is required to purchase them. High data prices and other barriers to entry also prevent nonprofit researchers from contributing to the field, resulting in a loss of in-depth research, accountability, and innovations that prioritize the social good.[79]

Bureaucratic Bloat

The bureaucratic burden of ensuring compliance with national regulations disproportionately impairs smaller firms and those who keep more strictly to the law over larger firms and those that do the bare minimum to meet standards. Nationally mandated qualification, test, and evaluation (QT&E) regulations tend to be supported – and are sometimes drafted – by America's leading technology firms, which can absorb regulatory costs more easily than their smaller competitors. In addition to reducing market competition, regulatory capture in the technology industry grants large firms an undue perception of commitment to ethical behavior, leading to additional advantages in federal procurement, contracting, and loan conditions. Once technology giants become government partners, the costs of regulatory compliance is passed to the taxpayer.

To promote competition, the United States and Europe often maintain exemptions for QT&E requirements for firms below a specific size or level of economic output. For example, the European Union initially mandated that only international firms with over 1,000 employees needed to report potential social and environmental risks to the government each year.[80] In 2024, however, these requirements were extended to upstream and downstream suppliers and subsidiaries as well as to U.S. firms with large EU customer bases even if they did not have European partners.[81] According to the European Chamber of Commerce, "It is not clear how companies will be able to comply with such requirements, as independent, third-party audits that are required to certify that they are not using

forced labor anywhere along their supply chains are difficult, and in some cases impossible, under current conditions in China."[82]

While sector-specific policies have fewer negative downstream effects, broad or overly rigid regulations drive bureaucratic bloat. The United States, like China, maintains significant breadth and agency when justifying new industrial policies as relating to the national interest or national security. Unlike Beijing, however, Washington is accountable to annual financial audits and bipartisan oversight mechanisms, making U.S. policies and initiatives far more costly to introduce and maintain than their PRC equivalents. Recent expansion of the scope of oversight of CFIUS and BIS strain these already-struggling capacities,[83] transforming what were intended to be agile and responsive entities into overlapping, multistakeholder conglomerates.

Escalatory Spirals

In the context of U.S.-China relations, American tariffs and other trade controls are implemented to motivate international policy change toward the U.S. and improve supply chain diversification and resilience. Unlike America's partners and allies, however, the Chinese state does not generally rescind or mitigate its trade restrictions in response to U.S. trade controls. Escalatory spirals such as the 2018 U.S.-China trade war and China's ongoing export cuts of critical minerals and electronics exemplify Beijing's inclination to retaliate rather than capitulate when faced with unilateral penalties from Washington.[84, 85]

Washington has further inflamed tensions by diplomatically positioning China as a military adversary rather than an economic competitor.[86] Industrial and trade policies are typically justified by threats to national security, either due to requirements in legal authorities or to secure bipartisan or public support. As these policies expand in scope and size, so do their national security justifications. Gradual rises in Washington's perceived threat level from China, bolstered by increasingly reactionary political messaging on both sides, could create a self-fulfilling prophecy where policies introduced to deter Chinese aggression counterintuitively escalate it. Near-misses and maritime incidents in the Taiwan Strait provide important reminders of how rising tensions in the highest political offices can trigger conflict breakouts at the lowest levels.[87]

Absent such a flashpoint, U.S.-China trade restrictions on commercial products and services strengthen China's authoritarian relationships and sacrifice valuable leverage that could be used to prevent future conflict. In the long run, U.S.-China decoupling strengthens China-Russia and China-North Korea cooperation in ways that may pose more risks to the international system than rewards to the United States and its allies. Decoupling also grants more power and agency to third states and multinationals, which impose two-way fees in exchange for helping importers and exporters reach new markets. For example, China is the world's largest liquefied natural gas (LNG) importer, and the United States is the most prolific LNG exporter. Due to export controls and tariffs, however, 72 percent of U.S. LNG exports are now sold at disadvantageous prices to multinational oil and gas giants like TotalEnergies and Unipec, which then resell these volumes to China.[88, 89]

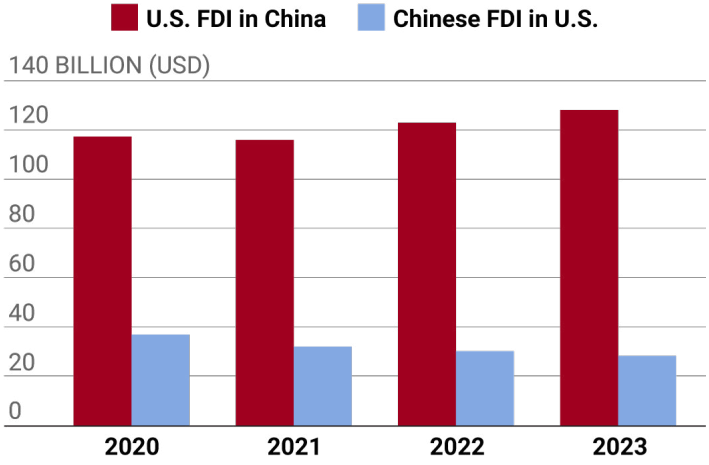
While some controls are needed to protect the most advanced defense tech from reaching Beijing, policymakers must keep in mind that the ideal U.S.-China relationship is built on international cooperation and trust, not isolationism and conflict. Trade and diplomatic cooperation prevent conflict and provide levers for de-escalation while improving economic diversity and returns.[90] Political off-ramps must be developed that enable new partnerships in nonstrategic sectors, even as restrictions are imposed on dual-use technologies. One proposal is a "clean tech détente," which would reset tariff and export controls on emerging technologies in the renewable energy sector.[91] Agriculture and beverage manufacturing are other sectors in which cooperation is unlikely to jeopardize U.S. national security or facilitate Chinese military intelligentization.

Recommendations

1. Diversify Critical Technology Investments

Regardless of strategy, the single most important metric of success of new innovation policies will be their resulting impact on investment into the American

Foreign Direct Investment



Source: U.S. Bureau of Economic Analysis

technology sector. To maintain U.S. dominance in critical technologies, Washington must invest in a broad range of competing entities, even if that means firms receive less as they grow and even if this strategy results in lower short-term returns than equivalent investments in technology giants. Leading economic experts suggest that U.S. policymakers should take a portfolio approach to investing in innovation, making small bets on a wide range of opportunities rather than continuing to prioritize national champions.[92]

In addition to supply-side policies like grants and tax incentives targeting non-R&D activities and firms outside the top six performers,[93] Washington maintains a broad suite of indirect mechanisms that can motivate domestic investment without infringing on its commitments to free and fair trade. Demand-side commitments expand market awareness of private-sector investment in emerging technologies.[94] As these subsidies can favor national champions, requirements such as friend-shoring downstream supply chains and due diligence requirements should be imposed on only the largest firms.[95]

While the U.S. government was neither structured nor intended to redirect large tax revenues into industrial policies, it is far more capable than China of accepting significant volumes of foreign investment.[96] Foreign direct investment (FDI) in the U.S. increased by $227 billion, to $5.39 trillion, in 2023, predominantly from Canada and Europe.[97] Unfortunately, recently introduced tariffs and investment restrictions threaten to reverse this trend. American outgoing direct investments exceeded incoming investments by $1.3 trillion in 2023, and with expected 25% tariffs on all Canadian imports starting in 2025,[98] the U.S. stands to lose tens of billions of dollars in FDI.

Meanwhile, cumulative foreign investment in China rose to $2.7 trillion in 2023, with significant inflows from Japan, South Korea, and Singapore.[99] In 2024, the U.S. directly invested $126.9 million in the PRC, whereas China invested only $28 million in U.S. industries.[100] Regardless of whether the Trump administration rescinds the United States-Mexico-Canada Agreement and applies these tariffs, convincing U.S. partners to redirect investments from China to North America and Europe is critical to stem China's development and diffusion of dual-use products and services.[101]

2. Promote U.S. Innovation Diffusion

Innovation diffusion is the process by which new technologies are spread internationally and applied to new sectors. To avoid the need for permanent public subsidies and maximize the impact of high-capital investments, the federal government is tasked with fostering commercial demand for cutting-edge technologies at home and abroad.[102] Public-private partnerships, international consultancies, and think tanks break down silos between innovators, investors, and regulators, accelerating the adoption and spread of new technologies.[103] Political risk advisory firms and media outlets sell the value of American products and services by bringing international awareness to the predatory market environment in China, although their transparency often makes them a target for wrongful investigations and forced closures by the Chinese Communist Party.[104]

Free trade is the second-largest contributor to innovation dynamism behind technology-sector investment. Reducing trade disparities promotes innovation diffusion, but the United States should not expect to see drastic changes in its trade deficit with China as a result of new tariffs or export subsidies. While the U.S.-China trade deficit decreased from $382 billion in 2022 to $279 billion in 2023,[105] evidence suggests this was the result of weakening domestic demand in China and discrepancies between globally

recorded figures rather than Chinese or U.S. trade barriers.[106, 107] In exchange for these limited effects, tariffs in the first Trump administration raised costs for domestic producers and importers and diminished U.S. economic well-being by 3%.[108] The same is true in China; according to the International Monetary Fund, China's approximately 5,400 subsidy policies from 2009 to 2022 had insignificant effects on subsequent export prices and quantities.[109]

Rather than impose trade barriers, the United States should design new trade and foreign infrastructure programs to provide developing nations a democratic alternative to China's Digital Silk Road initiatives. Foreign trade partnerships are highly effective in promoting innovation diffusion, particularly when the U.S. is the export partner.[110] America's trade deficit with all countries excluding China increased from $334 billion to $655 billion from 2018 to 2024,[111] demonstrating that the United States is the import partner in most new trade relationships. This trend is particularly salient in the strategically situated Indo-Pacific; while China has increased its export share to Southeast Asia by 5% since 2018, the U.S. export share climbed only 2.5% in that same period.[112]

A federal export strategy targeting key geostrategic regions would be the most efficient way to increase U.S. influence and reverse local shifts towards Beijing's political orbit. If critical technologies are deemed too sensitive or expensive to export to emerging markets, non-sensitive exports such as agricultural products can provide interim benefits and strengthen relationships while more complex investment and infrastructure programs are designed.[113]

3. Streamline and Reduce Barriers in U.S. Trade Policy

China's single-party system enables it to introduce broad, commercially unsustainable industrial policies for geostrategic purposes – specifically revenue maximization and market dominance.[114] By structuring the government to efficiently pursue these objectives, Beijing has driven down prices for some activities to an unsustainable level and introduced key bottlenecks in technology supply chains. However, as evidenced by the insignificant profit gains and lack of innovation dynamism of China's most subsidized firms, tariffs and subsidies alone fail to recoup public investment costs or drive the formation of a self-sustaining innovation ecosystem.

Rather than follow China's lead, Western countries must carve an opposing path. Thus far, Washington has responded to Chinese industrial policies by imposing trade controls, namely Section 301 and Section 232 tariffs,[115] to reduce U.S. and allied trade with China. However, these regulations tend to be incoherent, duplicative, and ineffective, and the loopholes that enable firms to obey them are rarely preferable to the status quo.[116]

End-user restrictions on military and some dual-use technologies continue to be necessary to prevent American innovations from being weaponized by foreign cyber adversaries. However, as long as U.S. enforcement mechanisms remain heterogeneous, overlapping, and fragmented, policymakers must be conservative with new trade restrictions and limit oversight mechanisms to clearly defined targets and objectives. Industry policies targeting environmental, social, and foreign governance objectives should be limited, nondiscriminatory, and temporary.

4. Promote Public-Sector Expertise and Digital Infrastructure

Public-sector technology expertise improves price formation and accountability in public programs, disincentivizing value-extractive and exploitative behavior by government contractors.[117] In addition to providing a counterweight to private-sector capital and knowledge monopolies, in-house critical technology programs are frequently better suited to public-sector needs.[118] The National Center of Artificial Intelligence has posited that military and intelligence agency talent deficits are "the greatest impediment to being AI-ready by 2025" and "the greatest inhibitor to buying, building, and fielding AI-enabled technologies."[119] For this reason, policymakers should insource private-sector talent, capacity, and expertise through programs like DARPA and ARPA-E/H/I, strengthen collaborations with nonprofit research laboratories, and publish open-source data sets where possible.

Reducing market entry costs and promoting experimentation in the private and nonprofit sectors

can improve market competition and service provision.[120] In combination with transparent, transferable public-private partnerships, these policies can also strengthen public-sector expertise. Some progress on expanding access to large data sets and cloud computing has come through public initiatives such as the National AI Research Resource Task Force and the Open Technology Fund, but more must be done to broaden the knowledge base of the field and promote free trade in ideas. A program like Germany's Sovereign Tech Agency, which uses public funds to support open-source digital infrastructure that can be used by a wide range of actors, could help democratize artificial intelligence development as well as improving cross-sector adoption of new innovations.[121]

5. Impose Costs Multilaterally, Not Unilaterally

The Trump administration has pledged to increase tariffs to upward of 60% on Chinese imports,[122] an action that threatens to push China further from the international free market system and toward retaliation and potentially rogue state status. Rather than engage in an escalation spiral with Beijing, U.S. policymakers should lean on third-party arbiters and multinational coalitions to impose costs and consequences. Reinvigorating multilateral mechanisms like the IMF, Organization for Economic Cooperation and Development, World Bank, and WTO could save hundreds of millions of dollars in implementation and oversight capacity compared to equivalent unilateral mechanisms. China has demonstrated a surprising pattern of respect for and compliance with WTO rulings,[123] as well as multilateral export control regimes more broadly. These mechanisms allow Beijing to save face domestically and demonstrate alignment with the rules-based order internationally, granting reciprocal benefits for American and Chinese policymakers and firms.

Notable critiques of international trade mechanisms are that they are slow, inefficient, and unable to benefit from privileged U.S. intelligence like their domestic regulatory equivalents. However, partner-selective mechanisms like the EU-U.S. Trade and Technology Council can coordinate regional trade and investment strategies and share the bureaucratic burden of industrial policy enforcement without unnecessarily magnifying intelligence vulnerabilities. While some multilateral agreements should be broad to impose comprehensive punitive effects, Five Eyes and other selected partners should receive additional direct intelligence on U.S. EAR rulings and be requested to adopt similar measures to magnify the effects of tariffs and sanctions. This strategy was illustrated after Biden and then-U.K. Prime Minister Rishi Sunak signed the Atlantic Declaration in 2023. Recognizing that sanctions cooperation would be difficult under current organizational structures, the United Kingdom disbanded and reformed its export control mechanisms to align more consistently with those of the United States.[124]

A required precursor of the success of large multilateral agreements is to avoid duplicating policies and practices that the U.S. condemns of China. Market competition is beneficial internationally as well as domestically, and actions taken to grant U.S. firms a significant undue advantage over their international equivalents will slow innovation, degrade trust, and increase complacency and costs. The United States was the leading recipient of WTO complaints between 2004 and 2018, and it has de facto suspended the appeals process by preventing the appointment of Appellate Body panelists.[125] Rather than continuing to deprioritize international dispute resolution mechanisms, the United States should hold China accountable to its duties and promises under the WTO and leverage its cooperation in restoring the Appellate Body to sign new multilateral agreements.[126]

Conclusion

Both China and the U.S. aggressively pursue cutting-edge technologies to enhance their domestic security and expand their foreign influence. However, China is gaining an asymmetric advantage over American firms by combining exploitation of U.S.-supported market and innovation ecosystems with large-scale industrial espionage, cyber intrusions, and protectionist policies. Rather than holding China accountable for these activities, the U.S. and Europe have chosen to introduce expansive tariff and industrial policy regimes of their own, catalyzing an international shift toward isolationism and protectionism that threatens innovation globally.

Without the same structural mechanisms that enable Chinese firms to benefit simultaneously from liberalism and authoritarianism, attempts to replicate China's "economic miracle" through trade restrictions on commercial and dual-use goods are unlikely to succeed in the United States. The scientific consensus is clear: Industrial policies in all countries should be narrow and targeted, with clear objectives and finite durations.[127] Rather than replicate the mechanisms and ecosystems developed by autocratic countries – which were only successful due to the availability of more open and technologically advanced innovation landscapes to exploit – the U.S. must reassert its commitment to the international collaborations and limited industrial policies that drove it to global technological dominance in the first place.

Encouragingly, U.S. policies to incentivize domestic innovation and democratize the critical technology landscape are showing signs of progress. In 2023, a record 5.4 million new-business applications were recorded by the Census Bureau, with high tech sectors such as information and business services seeing particularly elevated market entry and growth.[128] Despite industry assertions that Western governments will lose their strategic advantage in critical technologies due to self-limiting "ethical frameworks," these frameworks – in conjunction with nationally sponsored technology investment initiatives – are ensuring that the public good criterion is met and that as many participants as possible are able to contribute to that public good.[129]

However, balancing U.S. strategic objectives with market dynamics remains a challenge. Overreaching restrictions risk distorting domestic markets, consolidating competition, and discouraging foreign investment. Furthermore, an asymmetric preference toward domestic firms disincentivizes foreign investment and invites retaliation from U.S. competitors and adversaries, particularly China, in ways that do not benefit the U.S. or its partners.

Ultimately, the U.S. must resist the allure of emulating centralized industrial models and instead reassert its commitment to international collaboration, limited industrial policy, and the entrepreneurial spirit that has historically fueled its global leadership. After all, the true innovation that defines national progress rarely emerges from government decree alone – whether in laboratories or rented garages, it thrives in ecosystems where opportunity, collaboration, and creativity converge.

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