Time for a New National Innovation System for Security and Prosperity

By Robert D. Atkinson

In his 1989 classic *The Rise and Fall of the Great Powers* Paul Kennedy wrote, "To be a Great Power—by definition, a state capable of holding its own against any other nation—demands a flourishing economic base." Kennedy should have added, "an economic (and technology) base that is flourishing more than its competitors."

If that is the sine qua non of being a great power, the United States faces significant challenges and is at risk of losing its 75-year great power status. If the United States is to stay ahead of China militarily and technologically, it will need to essentially put in place a new national innovation (and production) system, because the current one suffers from serious shortcomings.

After World War II, the United States created the world's best innovation system (for example, the rules, incentives, funding, institutions, and relationships that support innovation and production). Once we won the cold war, U.S. leaders let it languish and shrink, while in turn embracing market fundamentalism (a belief that government should play a minimal role in supporting innovation) as the overarching economic policy doctrine that limits American freedom of movement to this day. Now facing a multi-decade great power conflict with China, it is time for the establishment of a revised and renewed U.S. national innovation system.[1]

To increase the chances of that happening, U.S. national security officials need to become more forceful advocates not just of an improved U.S. national security system, but of a greatly improved American innovation and production system. This new system needs to be grounded not only on a rejection of market fundamentalist thinking and the minimalist policies stemming from it, but also on a recognition that the current advocacy of many progressives for an industrial policy grounded in climate mitigation and "inclusive growth" will do little to address the China challenge.

The new innovation system needs to be focused on making U.S. advanced technology leadership—in both innovation and production—the central organizing principle of U.S. economic and national security policy while embracing an all-of-government approach to achieve that. Unparalleled U.S. leadership in advanced technology innovation and production—commercial and defense—is the best insurance against Chinese aggression. But America is at risk of losing that insurance relatively soon without a major change in policy direction and

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the establishment of an improved and more robust national innovation system on the order of ambition of the post–war system Congress and multiple administrations put in place, but now with a focus oriented to new commercial, technology, and global realities.

The China Challenge

During the 40-plus years of the Cold War with the Soviets, Kennedy's requirement was more than met, in part because the Soviet economy was structurally incapable of flourishing given its rigid command and control economic system. But U.S. flourishing was not an accident. It was largely the result of the establishment from the 1940s to the 1960s of a new national innovation system, the most effective the world has ever seen.

Today, while Russia remains an adversary, it is clear that the United States has once again entered an era of great power competition, now with China. China is a much different competitor than the Soviet Union. First, it is much larger. In 1990, the population of the Soviet Union was 15 percent larger than America's. Today, China's population is 320 percent larger, which means that even though its per capita income (in purchasing power parity terms) is just 17 percent of America's, its GDP (in PPP terms) is 9 percent larger.[2]

Second, China's economic system is not the Soviet Union's.[3] As Deng Xiaoping famously said, "It doesn't matter whether a cat is black or white, as long as it catches mice." While China is ruled by the Chinese Communist Party (CCP), it operates a capitalist economy, one in which the state is embedded in virtually all key sectors. Emblematic is the government's new decree demanding loyalty from companies to the CCP.[4] Because of this unique Chinese economic system, albeit one modeled in part on what the Asian Tigers did in the 1970s and 1980s, but powered by a more economically predatory state, China is the most formidable technological competitor the United States has ever faced.

Third, as Michael Pillsbury asserts in his book *The Hundred Year Marathon*, China has long harbored aspirations to become globally dominant economically, politically, and militarily. As the U.S. Department of Defense's Office of Industrial Policy's (OIP) annual report to Congress on the defense industrial base of China notes, "The Chinese Communist Party frames this strategy as an effort to realize long-held nationalist aspirations to 'return' China to a position of strength, prosperity, and leadership on the world stage.'"[5] Unlike Western nations that see trade, economics, and power separately, they are all apiece for China. As noted economist Alfred O. Hirschman wrote in his 1942 book *National Power and the Structure of Foreign Trade*, "the pursuit of power was still largely considered as a subordinate or exceptional aim of economic policy." The West still sees it that way. China does not, pursuing what China scholar Orville Schell termed, "wealth and power," which they see as intertwined.[6]

Which System is Better?

China approaches that goal with a very different approach than the United States. As General Secretary Xi Jinping stated, "System advantages are the greatest advantages of a country, and the competition of different systems is the most fundamental competition between countries."[7] So the key questions are: 1) who has the better system?, and 2) how can officials improve the American system?

Even with recent Chinese technological gains, the dominant view in the United States is that the U.S. system is superior, a view which leads to smugness and complacency. In part, this stems from an ideological conviction: by definition market systems are superior.

But America's smugness also stems from defining success differently than Xi. For Xi, success is not capital efficiency—the Chinese system wastes vast sums of money. Nor is it catching up to the United States in per-capita GDP. Success for Xi is making

China the global leader in virtually all advanced technologies and then using civilian-military fusion to ensure that China is preeminent economically, technologically, and militarily.

Doesn't Xi know that he is pursuing the wrong goal? For most U.S. economists, the right goal is allocating capital efficiently by allowing markets to be the principal allocator of capital. Once that is achieved, innovation and economic growth will follow. This is why many U.S. pundits dismiss China's economic challenge. They are right to point out that China wastes trillions of yuan, and that while it might be growing faster than America now, it will likely end up like Japan and the Asian Tigers, closing the gap with the United States but then stalling out far short of parity.[8] Therefore nothing to worry about: stay the course.

But this sidesteps the key question: does the Chinese system enable it to progress in ways that hurt U.S. national security and global techno-economic leadership? For purposes of projecting national power, including in defense, tech-based competitiveness is the key factor, not capital efficiency or productivity. And competitiveness includes not only the ability to invent and design advanced technology goods, but to also produce them, while ideally also shrinking your adversary's production.

If America's goal is to ensure national security and economic power, the key question is who has the better system for generating advanced industry competitiveness. At first glance it would appear to be the United States, since we still lead China in many tech areas.[9] But China has made rapid progress. The 2020 Global Innovation Index shows China ranking 6th in the world in innovation outputs (on a per-GDP basis). And China's Made in China 2025 plan and new Strategic and Emerging Industries plan take aim at the most important technologies sectors of the present and future.[10]

Participants interact with robots at the World Economic Forum - Annual Meeting of the New Champions in Tianjin, People's Republic of China 2018." (World Economic Forum photo by Greg Beadle, September 18, 2018)

Why Does Advanced Technology Competitiveness Matter?

Why should America care about China's closing the gap in advanced technology industries? To begin with, China cares. As the OIP writes, "China's economic development supports its military modernization not only by providing the means for larger defense budgets, but through deliberate Party-led initiatives such as the One Belt, One Road initiative and Made in China 2025, as well as the systemic benefits of China's growing national industrial and technological base."[11]

More importantly, a globally competitive advanced technology base supports U.S. national security in a multitude of ways. It leads to faster GDP growth, which makes it easier to afford "guns" and "butter." It reduces the trade deficit, enabling a stronger dollar, making defense imports cheaper. It is also a key ingredient in America's soft power, which is critical to convincing non-aligned nations of the superiority of the U.S. system.

A globally dominant industrial and technology base is also critical for supply chain integrity. The more our defense industry is dependent on foreign suppliers, especially China, the more vulnerable we are to disruptions. It is also critical to the defense industrial base. While some products that go into U.S. weapons systems are designed and built solely by specialized defense contractors, many depend on a strong advanced dual-use technology production system. As the OIP writes with respect to China, military-civilian fusion "means there is not a clear line between the PRC's civilian and military economies."[12] This is also true in America.

Finally, all three of DOD's "offset strategies" have been premised on the concept that the United States would maintain military superiority by technological sophistication. Having the best advanced technology industrial base is critical to the ability to stay ahead of the Chinese in advanced weapons technologies, such as AI-enabled warfare, hypersonics offense and defense, directed energy weapons, and others.

The State of the U.S. Defense Industrial Base

In 2010, a joint DOD–Homeland Security report stated; "The Defense Industrial Base (DIB) is an unmatched element of national power that differentiates the United States from all potential opponents."[13] But by 2019, OIP's report highlights key challenges, including:

- **Hypersonic weapons** where there are "significant challenges in developing manufacturing capability. . . . Hypersonic weapons rely on state-of-the-art technology in several critical components, many of which are only available from non-traditional defense contractors."[14]
- "**Nuclear warheads** . . . it is challenging to ensure that finished assemblies, systems, and subsystems exclusively leverage trusted, discrete components due to diminishing U.S.-based microelectronic and electronic manufacturing capability."[15]
- **Radar and electronic systems** face risks "driven by aging DOD systems that lead to obsolescence of available components, the fluidity of commercial technology, and decreasing U.S. industrial and manufacturing infrastructure."[16]
- The **soldier systems sector** faces "Industrial capability gaps."[17]
- **Military vehicles** face risks with "the rapid expansion of the electronic vehicle market likely to exacerbate these risks."[18]
- **Optics and photonics** have seen "U.S. value added manufacturing . . . eroded over the last 20 years, threatening U.S. first access and assured access to new optics and photonics defense capabilities."[19]
- **Space systems** where "due to market trends, supply chain globalization, and high manufacturing costs, future access to space qualified domestic industrial sources, such as microelectronics and solar cells, is uncertain."[20]

- **Electronics** are a problem where "gaps in the electronics sector reduce the ability to deliver technological advantage in capability, performance, and reliability against adversaries" and a "declining printed circuit board industry."[21]
- **Machine tools** where "corporate margins in the machine tool industry will not support the persistent level of investment required to support the timely development and adoption of key next-generation (and beyond) machine tool manufacturing capabilities that will be critical to the production of future national capabilities."[22]
- **Batteries, textiles, traveling wave tube amplifiers, shipbuilding, fiber-optic gyroscopes, solar cells for space,** and other technologies all face domestic production capabilities challenges.

Impacting all of this is the lack of a skilled workforce, where "the STEM shortage in the DIB is quickly approaching crisis status."[23]

These systemic challenges to the DIB are part and parcel of the same challenges to the broader U.S. industrial technology system.

The Importance of the U.S. Advanced Industrial Base

It is not just the narrowly defined DIB that is critical to national security; it is the broader U.S. advanced industrial base. This was true in 1791 when Alexander Hamilton wrote in his "Report on Manufactures" that "Not only the wealth; but the independence and security of a Country, appear to be materially connected with the prosperity of manufactures." It is true today, where the ability of the United States to field weapons systems, especially in time of war, and to sustain its leads in advanced weapons systems development, depends on the broad U.S. advanced technology base.

Most weapons systems rely at least somewhat on dual-use U.S. commercial providers. For example, DOD's trusted foundries produce only a fraction of the semiconductors needed for weapons systems; largely those that are designed by DOD itself or their contractors. But the vast majority of computer chips are bought straight from the commercial market. As the OIP writes: "support for a vibrant domestic manufacturing sector, a solid defense industrial base manufacturing sector, a solid defense industrial base and resilient supply chains is a national priority."[24] A strong commercial sector is critical to getting the scale economies needed to support innovation and low costs.

Moreover emerging technologies including advanced materials, AI, clean energy, biotechnology, hypersonic and directed energy technologies, metamaterials, quantum technologies, robotics, semiconductors (including beyond CMOS technology), and advanced computing are needed for the third offset and will rely to a significant extent on commercial sector capabilities. And yet as OIP states:

An ever-increasing share of military capability will rely on commercially sourced technology. The next iteration of defense technologies, however, will require much more overlap with commercial industry . . . the challenge for defense industrial base policy will be to incentivize a transition to new operating concepts enabled by next generation technologies, and to ensure that America continues to lead in them.[25]

We see this in space, for example, where non-defense companies, like Blue Origin, Virgin, SpaceX, and others are entering the industry.

The State of the U.S. Advanced Industrial Base

Unfortunately, the nation's commercial advanced technology sector faces significant challenges, despite what apologists say.[26] From 2007 to 2019, real manufacturing value added declined 13 percent.[27] And when controlling for the vast statistical overstatement of output growth in the computer industry (where dramatically faster computer chips are counted as increased output), it fell 20 percent.[28]

Moreover, the United States ran an all-time-high trade deficit of $133 billion in advanced technology products in 2019, compared to a $4.5 billion trade surplus in 2001.[29] With China, the trade deficit in electronic products was $184 billion in 2017.[30]

This decline is why Harvard Business School's Gary Pisano and Willy Shih noted, "Decades of outsourcing manufacturing have left U.S. industry without the means to invent the next generation of high-tech products that are crucial to rebuilding its economy."[31] It is why the OIP wrote, "The erosion of American manufacturing over the last two decades, however, has had a negative impact on these capabilities and threatens to undermine the ability of U.S. manufacturers to meet national security requirements."[32]

Should the U.S. Develop a New National Innovation System?

This gets to Xi's critical point about system competition. The Chinese system, even with the immiseration of its citizens—or perhaps because of it—is performing extremely well when it comes to advanced technology competitiveness. In contrast, the U.S. defense and broader advanced industrial bases face challenges. In this sense, the current U.S. system is not performing as well as it should be.

And this is the central issue: if the United States is to have any chance of staying ahead of China militarily and technologically it will need to make significant changes to its economic and technology development system, because as it currently operates, the system suffers from a number of serious structural challenges.

To understand the challenge and what the federal government needs to do, it is worth understanding the history of the U.S. innovation system.

The Post–War System

Many innovation scholars speak of a national innovation system, which is "the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies."[33] A nation's innovation success depends on an effective national innovation system.

Innovation systems differ over space and time. The U.S. system has seen distinct periods. In *Land of Prosperity,* Michael Lind argues that until the 1980s the United States had three distinct national innovation systems, the first from the founding of the Republic to the Civil War, the second from the Civil War to World War II, and the third until the end of the Cold War.

With World War II and the subsequent rise of the Soviet threat, the federal government constructed a new innovation system. The massive expenditures on weaponry and research and development (R&D) in World War II positioned the United States as the global leader in a host of advanced industries, including aerospace, electronics, machine tools, and others. The response to the Soviet threat—exemplified by Sputnik—helped cement America's technology leadership. By the early 1960s, the federal government invested more in R&D than every other foreign government and business combined.

In 1945, the Army published a policy affirming the need for civilian scientific contributions in military planning and weapons production. In 1946, Congress created the Atomic Energy Commission and a system of national laboratories. DOD established the first federally funded research and development center (FFRDC) RAND, and University Affiliated Research Centers in 1947. Congress passed the Defense Production Act of 1950 and also created the National Science Foundation. Eisenhower pressed for the passage of the Interstate Highway Act. The Defense Advanced Research Projects Agency (DARPA) and the National Aeronautics and Space Administration were established in 1958. This funding enabled the development of a host of critical technologies we enjoy

today, including jet aircraft, the internet, GPS, LED lighting, microwaves, radar, networked computers, and wireless communications.[34] And it provided the critical, although usually overlooked, inputs to America's key technology hubs, including Boston's Route 128 and Silicon Valley. Indeed, even in the late 1980s, Silicon Valley's Santa Clara county received more DOD prime contract award dollars per capita than any other county in the United States.

This system was based on three factors. First, government's role in innovation was larger than the business role and therefore, government needed to be a principal actor; much innovation "spun-off" from defense. The second was that not only was the U.S. production system national (relatively few corporations had major offshore production facilities), but also our allies had relatively limited capabilities. Third, much of the technical focus was on engineering, electronics, and chemistry.

The U.S. military-industrial complex, as it was sometimes called, was unparalleled in the world. As Chen argues, the federal government, "provided the critical financial resources required to take embryonic technologies and develop them at a speed unlikely to be matched by the civilian market."[35] This key role of defense led to the quip, "America has had three types of industrial policy: first, World War II, second, the Korean War, and third, the Vietnam War."[36] Even as central as this system was to propelling the United States to global leadership, almost no one framed it as an industrial policy: it was a defense policy, space policy, energy policy, etc. As such, it was the "hidden developmental state."[37] Not to worry, the narrative went, the United States still a fully market-based economy.

To be sure, there were many voices in the post–war era that were opposed to this unprecedented entry of the federal government into what had hitherto been a more private sector-led national innovation system. Republican Senate Leader Robert Taft worried that the effort to meet Soviet challenge meant that the nation had, "wandered far from its true purpose to preserve the peace and liberty of the people of the United States."[38] And in his final White House speech, President Dwight D. Eisenhower warned that, "we must guard against the acquisition of unwarranted influence, whether sought or unsought, by the military-industrial complex." However, fears of changes to the core principles of the Republic were overwhelmed by even stronger fears of Soviet dominance.

The Post–Cold War System

America and its allies won the Cold War in part because of American strength, but also because of internal weaknesses in the Soviet system. In a blink of an eye, a 40-year struggle was over, and with it a sense of national purpose that propelled the United States to invest massive resources to, "distort the free market." In a short time, U.S. military superiority over any adversary was so completely overwhelming that many in America became blasé. "Shock and awe," meant the thinking was so easy, we could take our eye off the ball of technology advancement. As the Soviet threat disappeared, we appeared to be, in the words of Francis Fukayama, "at the "End of History," with market-based, democratic systems triumphant.

At the same time, the 40-year embrace of Keynesian economics which included a role for government innovation policy (albeit a hidden one), had started to weaken. The rise of "stagflation" (economic stagnation coupled with inflation) in the late 1970s opened the door first to conservative, "supply-side economics," which focused on shrinking government and reducing taxes, and then soon after to a broader embrace of market fundamentalism. Moderate and many liberal economists differed little from conservatives in this, other than in their focus on cutting the budget deficit and using government to address inequality.[39] The 1990s saw the confluence of both streams; market fundamentalism and a shift away from a mindset focused on maintaining military and

The Cold War came to an abrupt end with the fall of the Berlin Wall in 1989 followed by the dissolution of the Soviet Union in 1991." (Raphaël Thiémard, November 1989)

technology leadership. The result was that to this day neoclassical economics, or what David Sainsbury terms in his book *Windows of Opportunity*, the "market efficiency school of thought," now governs U.S. economic thinking and action to this day. Market forces became holy and government profane, at least when it came to driving economic growth.

With no need to "keep up with the Soviets," we could dismantle the defense industrial complex and repudiate the hidden development state. But policymakers didn't rip it out root and branch: interest group politics make that difficult. Instead, in the words of libertarian Grover Norquist, we "starved the beast." DOD prime contract awards fell from 3.62 percent of GDP in 1984 to 1.72 percent a decade later (and today are at just 1.79 percent).[40] Federal spending on R&D fell from around 1.5 percent of GDP in the early 1960s, to just around 0.6 percent today.[41] In 1986, Congress eliminated the investment tax credit.

In short, by default, federal leaders enabled a new innovation system. It looked somewhat like the old one. There were still defense contractors, although fewer. There were still federal labs, although smaller. And there was still federal R&D support for universities and companies, though much less. The new prevailing ideology of market fundamentalism saw this shift not as a problem, but a solution. After all, markets get it right, governments do not.

This evolution was not inevitable. In the 1980s, when the competitive threat from Japan (and to some extent Germany) was foremost in many people's minds, the federal government could have pivoted to create a new kind of national innovation

system, one focused not just on defense but also on commercial innovation. This challenge led many to propose that the United States adopt an industrial policy (a combination of support for innovation and manufacturing production in an array of industries). However, the response from the neoclassical priesthood was swift and severe; "no, in fact, hell no!" Economist Gary Becker wrote that, "[t]he best industrial policy is none at all."[42] John Williamson, the economist who coined the term "the Washington Consensus," wrote "[l]ittle in the record of industrial policy suggests that the state is very good at 'picking winners'."[43] Lawrence Summers wrote that government, "is a crappy VC" (venture capitalist).[44] In a seminal article, Brookings economist Charles Schultz put the nail in the industrial policy coffin writing, "We have enough real problems without creating new ones."[45]

These views were not the product of empirical economic research. In fact, when economic research found that industrial policy led to faster GDP growth, economists still rejected it because it distorted the market.[46] Without an external threat requiring the U.S. economy to lead in advanced technology production, America could go back to an idealized free market system (that never existed) where markets determined industrial composition; a world in which "potato chips, computer chips, what's the difference" was the dominant view. As Robert Wade wrote, market fundamentalism, "reinforced the longer standing hostility to any idea of 'industrial policy,' the hostility spanning Congress, the executive branch (especially the Department of the Treasury), the media, think tanks, academic economics departments."[47]

This leads to two questions; first, why does the United States lead in innovation if it hasn't had a technology strategy? The answer is that America put in place the most effective technology strategy in history, but it wasn't called that; second, why is it that a country that espouses free markets put in place the best technology strategy? The answer is that it was not labeled as industrial policy, and national security concerns trumped any philosophical concerns about market distortion. Once the Soviet threat was gone however, so too was support for that techno-economic system, and as a result, today the U.S. advanced technology economy is living off of past accomplishments.

The Case for an Expanded and Reformed System and the Challenges

In short, once the cold war was won, U.S. leaders let the U.S. innovation policy system languish and gradually shrink, embracing market fundamentalism. However, with what Michael Lind calls the, "New Cold War II" (a multi-decade, great power conflict with China), it is time for an expanded and reformed national innovation system.[48] In the first Cold War, the Soviet Union was a military rival but not a commercial rival. Japan was a commercial rival, but not a military rival. Today China is both and racing ahead with the development of potentially disruptive weapons, such as cheap and numerous autonomous weapons systems and hypersonic missiles, which, without major U.S. innovation in turn, could be devastating. Our overwhelming technology lead over adversaries has shrunk.

This means that policymakers need to stop separating geopolitics from geoeconomics, and as Lind notes, "adopt the classic great-power practice of treating the military, diplomacy, and trade as three coordinated instruments of a single strategy." A core component of this is to improve the domestic innovation system to speed up our rate of innovation (and production) so that we remain ahead of China for as long as possible.

This is why the debate about China is so central. If one rejects the notion of China as a strategic threat, as some foreign policy pundits and many progressives do, then it is easier to reject the need for a new American innovation system. If our

innovation system has worked over the last three decades, why tinker with it? But if China is a new strategic threat, this suggests that the federal government will need to take actions on the magnitude of what it did from 1945 to 1965.

Marshalling the political support for building a new national innovation system will not be easy. Many entrenched economic interests will fight it. Many universities will oppose requirements that government support for R&D be focused on strategic priorities instead of principally what university professors are interested in. Wall Street will fight it because any effective strategy requires shrinking the oversized role of finance. And some domestic serving sectors will oppose policies, such as tax incentives, focused on advanced industries. The list goes on.

Moreover, political ideologues on both sides of aisle will oppose such an agenda. Some conservatives will claim a new innovation system means going down all sorts of bad paths; socialism, crony capitalism, etc. Some will paint it as one step away from a Soviet Gosplan system.[49] Some budget hawks will balk at increases in federal investment. And some conservatives will prefer to retreat to a Robert Taft-oriented national security policy, seeking limited U.S. engagement overseas, and avoiding the need to ramp up innovation.

Likewise, many progressives will deny that China poses a military challenge and will reject calls for a stronger defense system, preferring instead to reduce defense spending.[50] And while many progressives will support an increased federal role, it will be one based on redistribution, such as universal health care, free college, and even universal basic income.[51] Likewise, many progressives will reject policies that provide help to big business in advanced technology industries, arguing that big companies are inherently bad and should be broken up and otherwise constrained. And to the extent progressives will support a robust industrial strategy, for many it will be limited to a "Green New Deal," where everything is about carbon reduction: DOD will likely be expected to buy electric tanks and F35s powered by biofuels.

Finally, some will listen to Silicon Valley-type techno-libertarians who proffer claims that innovation is now bottom up and self-organizing and that the so-called "Singularity" is near. All we need to do is give everyone a 3D printer and unleash their creativity for a new innovation renaissance, all supported by rich tech philanthropists.[52]

At the core, these differences are about what is America's most important national mission. If it is defined as freedom, climate, racial justice, or reduced income inequality, then the task of putting in place a new national innovation system to support America's global tech leadership will be challenging. If it is defined as maintaining our lead over China, it will be easier. China has no ambiguity about its mission. As the OIP writes, "The CCP prioritizes economic development as the 'central task' and the force that drives China's modernization across all areas, including its armed forces."[53]

The United States knows how to formulate and implement effective industrial policy; we did it for 40 years after WWII. But because of the deeply held beliefs in free markets and individualism, America needs a justification to deviate from these principles. War—hot or cold—has been a key justification since the founding of the republic. Today, winning the cold war that China has effectively started provides a strong justification for once again embracing a national developmentalist agenda.

This gets to the national security community's role. There is an iconic TV commercial from the late 1970s advertising a stockbroker firm, that says, "When EF Hutton talks, people listen."[54] Today we are in the same situation when it comes to a national advanced industry strategy: when national security officials talk, many policymakers listen. Arguments made by a small cadre of national developmentalist scholars and think tanks, and by some technology firms and industry associations only go

so far. Unless the national security establishment makes its voice heard that the future security of the republic depends on the United States developing, funding, and implementing a new sophisticated advanced industrial strategy—not just a narrow, incremental DIB strategy—progress will be slow at best, possibly negative.

Currently, it is no one's job to advocate for a more robust national advanced technology strategy. Ideally, most economic policy think tanks, economists, pundits, and media figures would realize that it is time for a new U.S. industrial strategy. But given entrenched views, that is not likely to occur, at least in the time frame needed. This means that the national security community needs to do more than place stark findings in DIB reports to Congress (on page 114!) Senior officials need to take risks and develop the political license to forcefully advocate for a more robust national innovation system.

What Should the New System Look Like

The United States needs a new national innovation system. Before describing that, here's what it should not be. A new system is not a bit more of the old; a bit more money for DOD, a bit more money for science funding, a bit more openness to high skill immigration.[55] Unfortunately, much of the current narrative embraces this incremental approach because many people do not believe that the politics are ripe for the creation of a new system. It is all well and good to make realistic recommendations that reflect current political realities, but everyone involved needs to also say that incrementalism won't cut it.

Nor can the new system be based on a hope that the private sector will take the sufficient steps needed that are synchronous with national defense needs. Hamilton got it right in 1791: "There appears to be an improvidence, in leaving these essential instruments of national defence to the casual speculations of individual adventure." Today, as the Center for a New American Security writes, "The DOD is betting on the private sector to take advantage of larger investments and faster innovation cycles."[56] But it is not at all clear that this will be enough, particularly as U.S. companies continue to shift their R&D from "R" to "D."[57] A corollary is that the FAANGs (Facebook, Apple, Amazon, Netflix, and Google) will save us. Yes, the FAANGS are important for software and AI, but U.S. defense needs are much greater and broader.

Another cul de sac is the idea that as long as the United States leads on the development of "ethical technology," all will be well. The National Security Commission on AI writes that, "government must strengthen industry by articulating clear standards and policies for responsible use, rebuilding trust through greater transparency and offering a vision of shared purpose."[58] Trust might be useful, but there is no evidence that U.S. industry will fail to produce trustworthy systems, and even less evidence that trust determines U.S. leadership.

Rather than incrementalism, it is time to think big, establishing a new system grounded in two principles. First, policymakers can no longer be indifferent to U.S. industrial structure. They need to articulate that there is a set of industries "too critical to fail"—such as aerospace, biopharmaceuticals, sophisticated computers and semiconductors, advanced machinery and equipment, software, and artificial intelligence. Second, while business must lead, government has to play a strong supporting role.[59]

The most important step to get to a new innovation system is for elites and policymakers to agree to this new national mission and then ensure an all-of-government approach to implementing it. Without this agreement and alignment, progress will be limited.

There are a host of steps government needs to take. Making industrial and innovation greatness the new defining mission means ensuring that federal agencies and policies do less to limit innovation. As one example, for over half a century, U.S. antitrust policy has been led by the Department of

Justice and the Federal Trade Commission, with little input from DOD and DOC. The result has been a series of disastrous antitrust decisions that enabled foreign competitors, including Japan and China, to get a leg up.[60]

Second, Congress needs to appropriate significantly more funding for innovation-based competitiveness, both directly and indirectly (through tax expenditures) and for defense and commercial innovation, and encourage commercialization and production of the resulting technology domestically. This means at least $100 billion more a year in R&D funding, with most of this going to applied research and engineering, including on process R&D, focused on key dual-use technology needs. Legislation like the Senate Democrat LEADS act, the bipartisan Endless Frontier Act, and the CHIPS/American Foundries Act are important steps in that direction.

Some will argue that we don't need more spending; after all, government spending on R&D is the same as it was three decades ago in inflation-adjusted terms. There are two problems with this view. First, America is competing with China, which is funding vastly more R&D than three decades ago. Second, as Nick Bloom and colleagues have shown, the global productivity of R&D has fallen.[61] To take DARPA as an example, its funding as a share of GDP has fallen by half, which means that DARPA innovation outputs have likely fallen by at least three quarters, relative to GDP.

Others will argue that defense funding no longer produces the big commercial innovations of the past, like the internet. But defense innovation in the last decade has produced commercial innovations. And commercial firms that partner with the government on national security projects can be more competitive in commercial markets because of a core customer. Moreover, emerging defense technology innovations, like autonomous weapons and the "kill web" (an interlinked and flexible missile system with ubiquitous sensors), could generate important commercial innovation benefits.[62]

Third, Congress should also significantly expand support explicitly focused on commercial innovation. It should expand the Manufacturing USA Institutes.[63] It should reestablish National Institute of Standards and Technology's (NIST) Advanced Technology Program, a program that funded joint R&D partnerships. It should establish a state-federal R&D and production partnership fund to encourage states to invest more in R&D, and incentives to attract to the United States key production facilities, such as in semiconductors and other key industries. Most states are focused on technology-based economic development, but without federal help suffer from vastly limited resources. Congress should also establish special purpose, non-profit, commercial industrial technology institutes, modeled after Taiwan's Industrial Technology Research Institute.[64]

A related issue is global technology standards. China has expanded its influence in institutions which shape global innovations standards, including the International Telecommunication Union and the 3rd Generation Partnership Project. Moreover, it appears that China wants to dominate those and other institutions, as its forthcoming China Standards 2035 plan is likely to show.[65] The United States and allies will need to cooperate to be more deeply engaged in these bodies. Moreover, Congress should extend the R&D tax credit to make company expenditures on global standards setting eligible.

Moreover, whether by expanding the Independent Research And Development (IRAD) program, which allows companies to initiate and conduct R&D projects of interest to DOD, or through other means, Congress and DOD need to provide more incentives for defense contractors to invest in R&D. The Big Six contractors spent on average 3 percent of their sales on R&D, compared to around 10 percent for leading commercial tech companies.[66] If we are to keep our lead over China,

defense contractors will need to invest more in R&D, particularly riskier, longer term R&D. In addition, Congress should fund the Defense Innovation Unit proposal to create an InQTel-like venture arm for investing in promising hardware-based startups, and consider supporting the creation of similar venture units in each of the military services.[67] This should be in the service of overall reform at DOD to enable it to be more flexible, innovative, and fast-moving. As John Hyten, Vice Chairman of the Joint Chiefs of Staff recently noted, "our Department has become expert at moving slow."[68]

Fourth, government demand can spur innovation, whether it is procurement of new weapons systems, or investment in "smart infrastructure."[69] This means designing government procurement to support innovation where possible, as nations like the UK and Germany have done.[70]

Fifth, Congress should expand tax incentives for innovation, including a much more generous R&D credit, a new credit for investing in machinery and equipment, and an expansion of the R&D credit to include workforce training and global standards setting expenditures.[71] Expanded incentives will be particularly important to help counter the likely decline in business investment, including in R&D, in the wake of the COVID recession.[72] Congress should also put in place policies to reform corporate governance and equity markets to discourage corporate short-termism.

Sixth, Congress should establish vehicles to support domestic investment in advanced technology industries, including reforming the Small Business Administration, as Senator Marco Rubio (R-FL) has proposed, and providing either tax incentives or direct funding to create a national industrial investment bank.

Seventh, more needs to be done to support domestic STEM skills, particularly in computer science and engineering. The evidence is clear that more federal support for R&D is an important driver of STEM education, especially at the college level. But new and creative STEM initiatives are needed, such as tying federal funding to the states to incorporate engineering and computer science education in high schools, providing incentives for colleges to produce more STEM graduates, and providing aid to state universities to accept more in-state STEM students rather than students from China who pay out-of-state tuition. In addition, Congress should expand DOD STEM incentives to make defense contractors eligible. It should also consider the proposal by The National Security Commission on Artificial Intelligence to establish a digital reserve corps and digital service academy to increase the pipeline of tech-savvy workers into the public sector.[73]

Eighth, Congress should establish a new national strategic technology agency, that would include capabilities both for program management, like DARPA has, but also analytical capabilities to better understand U.S. dual use and commercial technology base. This could be housed at NIST, which would manage this, as well as the Manufacturing Institutes, a new Advanced Technology Program, and related programs.

Ninth, while the lion's share of effort should be focused on domestic actions, it would be a mistake not to try to limit China's tech advance, particularly through its unfair and often illegal efforts. At the same time, policymakers should resist calls for radical decoupling. Tom Friedman may have been wrong with his McDonalds quip that no country with a McDonalds got in a war with the United States, but if China and the U.S. economy are significantly decoupled, the costs of China engaging in military action against U.S. interests will be higher. There are McDonalds in China and in Taiwan, and that's not in any way going to stop the former moving against the latter. We need decoupling in certain areas and entanglement in others.

Finally, a U.S. industrial strategy should not be American only. This means eschewing "Buy

Navy Lt. j.g. Justin Bishop and Chief Petty Officer David Thompson keep watch in the navigation bridge aboard the USS Sioux City in the Caribbean Sea." December 21, 2020 (Photo by Navy Seaman Juel Foster, Nov. 23, 2020)

American" mandates which will just alienate allies and raise prices. It does mean developing a technology strategy that is closely aligned with our allies' strategies. Given the complexity of technology industries, even the United States cannot hope to be a leader in all critical technologies, including in 5G systems.[74] But it needs to ensure that if it isn't a leader, then at least one of our close allies is. In this sense, the United States needs not just a national industrial strategy, but also an allied industrial strategy to ensure that as a group, allied democratic nations have the capabilities to produce innovative products at competitive prices in a set of key areas.[75]

Conclusion

In geoeconomics terms, the United States has lost considerable ground to China over the past 20 years. Ground, that with honest and realistic attention to the state of international economic affairs, it did not need to cede. As Michèle Flournoy, former Undersecretary of Defense for Policy, writes, this matters because, "As tensions continue to rise and Chinese assertiveness in the region grows, it will take a concerted effort to rebuild the credibility of U.S. deterrence in order to reduce the risk of a war that neither side seeks."[76] That credibility for deterrence is based on the United States being the clear and unquestioned leader in innovation and production across most major technologies.

If Congress and the next administration do not implement a new, more-robust national innovation system (call it what you like: an industrial strategy, an industrial policy, a competitiveness strategy; it doesn't matter), to ensure U.S. technological superiority, the United States will likely fall behind China technologically, at least on too many

critical technologies, with dire consequences for U.S. global power, national security, and prosperity. Thankfully, many in Washington have awakened to the realization that America may need an advanced technology strategy. But if the national security establishment does not take a proactive role in pushing for such a forward-looking, bold strategy, the odds of such a strategy being adopted are likely modest at best. PRISM

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