

Silicon Triangle

The United States, Taiwan, China,
and Global Semiconductor Security

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CHAPTER ONE

Scenarios for Future US-China Competition

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Forming a strategy on semiconductors depends on one's expectations about the future nature of US-China relations, the motivations of other global participants in critical supply chains within that context, and Taiwan's own environment. Today's analysts—including those among our working group—unsurprisingly hold different expectations about how these futures will unfold.

We therefore begin our analysis by creating a scenario-planning framework to consider what the key drivers of the US-China-Taiwan relationship may be over the next decade—and the different futures they may yield. In particular, we focus on the impact of (a) global trade decisions and (b) the locus of leadership in critical technologies.

This chapter describes four resulting scenarios for the United States', China's, and Taiwan's roles in the world—some appealing, and some less so—and the implications of those potential futures for (1) what the United States should do to reduce current vulnerabilities to semiconductor supply chain disruptions; (2) how that can be done in a way that promotes stability in the Taiwan Strait; and, in doing so, (3) guard against new vulnerabilities as China further develops its own semiconductor industry. A key lesson is that if we look to be heading toward one of those worlds, we can take tailored policy steps to improve our security and our prosperity within it—or we can shape the drivers of that future to avoid it altogether.



Many of the most consequential shifts in recent decades have defied assumptions and expectations. From the fall of the Berlin Wall and the “end of history” to the more recent global resurgence of authoritarianism accentuated by the first major war in Europe in seventy years, conventional wisdom has sometimes proven to be too conventional and not nearly wise enough. That has certainly been true in relation to China’s transformation of its economy and its role in the world, from the dawn of Deng Xiaoping’s era of “reform and opening up,” through China’s rapid economic and political rise, to Xi Jinping’s tighter control at home and pursuit of greater wealth, power, and influence abroad.

Today’s observers can reasonably hold quite different expectations about the future of US-China relations, the reordering of global trade and technology leadership, the status of Taiwan, and the future of the liberal international order.

In global trade and technology, semiconductors now play a pivotal role. US policy makers increasingly recognize the need for a reliable and resilient supply chain of semiconductors for the United States and its partners.

Most semiconductors are now fabricated in East Asia, with almost all leading-edge semiconductors fabricated by Taiwan Semiconductor Manufacturing Company (TSMC) in Taiwan. China has, in recent years, become more aggressive in asserting its claims of sovereignty over Taiwan—just when China, like the United States, needs the kind of leading-edge semiconductors TSMC makes, but has not yet developed the capability to make them domestically.

In the face of all this, prudent planning requires not just deterrence against aggressive action from China but also a collaborative strategy for a more robust and resilient global semiconductor supply chain. Such planning also requires consideration of how key variables may play out in the near term. Our working group scenario team has used a timeline of ten years to consider how alternative futures could affect global semiconductor supply chains.

Scenario planning requires contemplating what is plausible, not making hard predictions about what “will” happen. Our participants identified critical uncertainties and then imagined futures in which different

combinations of those variables may shape different—even opposite—possible futures. The group then considered the actionable implications in each scenario. This process was done with the recognition that the *actual* future may include elements of some or all of the imagined scenarios, or may move from one scenario to another. The point was to think and prepare in a way that optimizes the outcome for each scenario while also identifying actions that may be common to more than one.

Scenario planning has been used by organizations, companies, and governments for over forty years, enabling them to remain open-minded and to hedge against risks. The technique was pioneered by Shell Oil and made prominent by the Global Business Network's founders Stewart Brand, Napier Collyns, Jay Ogilvy, Peter Schwartz, and Lawrence Wilkinson.

Wilkinson himself led this report's working group through a scenario-planning deep dive. We aimed to develop answers to our key questions, with related implications, and then to produce a set of recommendations that would be effective in all the futures we thought were plausible.

To do this, a small subgroup composed of retired senior military officers, China specialists, economists, semiconductor specialists, strategists, and others met regularly over three months in 2022, reporting back regularly to the larger group. This subgroup thought about the forces that could influence how we answer three main strategic questions:

1. What should the United States do in the near term to reduce current vulnerabilities to semiconductor supply chain disruptions, and over time to create more assured and durable access to the types of semiconductors needed, when they are needed?
2. How can this be done in a way that preserves Taiwan's current self-governing status, underpins its prosperity and innovative vitality, and promotes stability in the Taiwan Strait?
3. How can the United States and its allies guard against new vulnerabilities as China further develops its own semiconductor industry, and anticipate the next strategically important technology industry competition?

To imagine different plausible futures, our full working group of over two dozen experts came up with more than two hundred driving forces that could shape the next decade. Our scenarios subgroup narrowed the list down to forty driving forces and then, finally, down to just two driving forces, considered by the subgroup to be the most relevant to the three main strategic questions. These are shown in figure 1.1.

1. *Global Economy*: Whether the global economy becomes more integrated and “flat” or more hived up into blocs.
2. *Technology and Innovation*: Whether the United States continues to lead in technology in general, and semiconductors in particular, or China takes the lead.

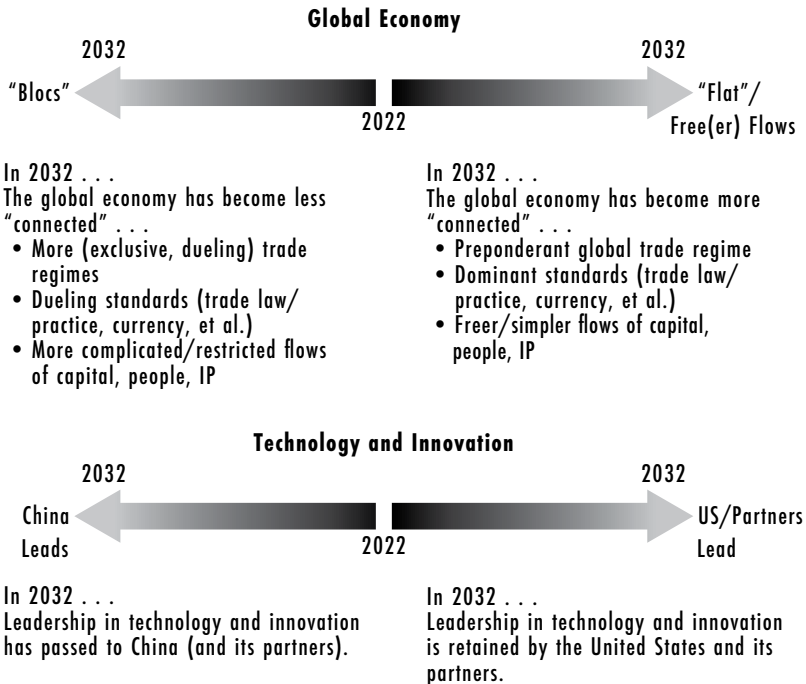


Figure 1.1. Scenario Logics

The two chosen variables can be visually presented as a four-quadrant grid, as shown in figure 1.2, in which each quadrant represents a distinctly different future.

Each of these futures pushes as far as we can plausibly go in our ten-year time frame, and each uses “outside-in” thinking—that is, understanding external dynamics and drivers that might affect the issues at hand. This approach illustrates the range of challenges and opportunities the United States and its allies might face, given the variables we chose.

Scenario planning can help decision makers think in advance about what they would do if they saw early signs indicating movement in a particular direction, and what that direction means for their interests. It may signal that they should seize opportunities or take defensive action. Some actions and strategies are “robust”—ones that make sense in any of the imagined plausible futures. Others are “contingent”—beneficial in some futures, harmful in others.

Early in this process, subgroup participants were asked to think back to what the world looked like a decade ago, and to share what they were sure would happen that didn’t and what did happen that surprised them. Everyone had something to contribute on both counts. And, of course, the same is likely to manifest in the next decade as well.

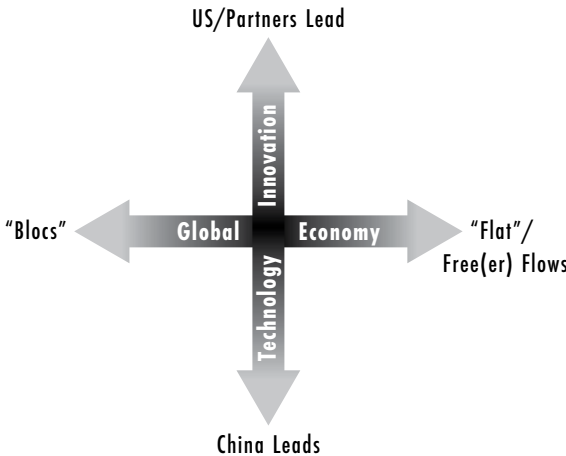


Figure 1.2. Scenario Logics Applied to Two Axes

The world may become more multipolar and multialigned. New players may arise in the technology space in general, and in the semiconductor sector in particular. Whatever happens, the scenarios we created can be updated and adjusted as the future unfolds, allowing implications to evolve that can better inform strategy in a changing environment.

Driving Forces

The following driving forces are what our scenario team felt could most likely impact US-Taiwan-China relations, especially pertaining to semiconductors, over the next decade. The forces below are listed in rough order from most to least influential, according to the scenario team:

1. War or other disruptive conflict or action

In a large-scale conflict involving Taiwan, semiconductor manufacturing, along with a variety of other industries, would be catastrophically disrupted, and the US economy would suffer negative downstream effects. More limited hostile actions, such as a cyberattack on TSMC, would have similar effects.¹ Other conflicts in the region or beyond could have downstream effects on the global semiconductor industry, such as sanctions against an aggressor.

2. Degree of policy coordination among the United States, Europe, and Asia on security and economic competition with China

The United States is increasingly coordinating with its partners to compete with China. Such efforts include the Quadrilateral Security Dialogue (“Quad”) among the United States, Japan, Australia, and India; the AUKUS security pact among the United States, United Kingdom, and Australia; the G7’s “Build Back Better World” (B3W) developing world infrastructure financing initiative²; the EU-US Trade and Technology Council (TTC), and other efforts at EU-US strategic cooperation³; the Clean Network initiative for safeguarding communications and network traffic from People’s Republic of China (PRC) vendors such as Huawei⁴; and the Chip 4 Alliance of the United States,

Japan, South Korea, and Taiwan. Most recently, the US CHIPS and Science Act has codified dozens of incentives, subsidies, restrictions, and new or expanded partnerships.

3. Rate of technological progress in strategic sectors

A dozen key advanced technologies relevant to US national security are detailed in the National Science and Technology Council's February 2022 update of its Critical and Emerging Technologies List.⁵

4. TSMC's degree of regional diversification of production

Most of TSMC's manufacturing sites ("fabs") are currently in Taiwan, with two smaller fabs in China and one in the United States (Camas, Washington). TSMC is in the process of building two advanced-logic fabs in Arizona,⁶ and another fab in Japan through a joint venture with Sony.⁷

5. Use of public policy tools to increase research and development (R&D) spending and innovation on semiconductors in the US private sector

The CHIPS and Science Act of 2022 offers \$39 billion in federal subsidies for semiconductor foundry construction, including loan guarantees and a federal-to-state or local subsidy match program; in addition, it creates a 25 percent investment tax credit for semiconductor manufacturing facilities and equipment. Further, the CHIPS Act appropriates significant new R&D funding through the Department of Commerce—\$11 billion—for novel public-private R&D programs including a National Semiconductor Technology Center and a Manufacturing USA Semiconductor Institute, plus a federal National Advanced Packaging Manufacturing Program.

6. Choices on sales destinations made by semiconductor manufacturing equipment vendors, or their host governments, such as the Dutch company Advanced Semiconductor Materials Lithography (ASML)

ASML's extreme ultraviolet (EUV) lithography machines are a critical piece of the advanced-semiconductor manufacturing process, because

they are used to etch integrated circuit designs into silicon wafers at the smallest scales. ASML, Canon, Nikon, and others produce deep ultraviolet (DUV) lithography machines to make chips one or two generations behind the leading edge.⁸ A decision by ASML, other equipment firms, or their governments to refuse selling to China—or to other countries willing to sell to China—would limit China’s ability to compete globally on this front.

7. Extent to which regionalization replaces globalization

Populist nationalism or the weakening of multilateral institutions such as the International Monetary Fund (IMF), World Bank, World Health Organization (WHO), or even the UN Security Council could contribute to greater regionalization. Trade barriers and restrictions on flows of people, capital, and intellectual property may lead multinationals to continue building regional supply chains that hedge against geopolitical risk, expanding on the trends begun during the COVID pandemic.⁹

8. Ability of China to create a semiconductor manufacturing firm that meets or surpasses TSMC’s capabilities

Efforts by China’s government to bolster semiconductor manufacturing capacity are expected to increase chip manufacturing market share in non-leading-edge semiconductors over the next decade. Far less certain, however, is whether China’s Semiconductor Manufacturing International Corporation (SMIC) or another enterprise in China could catch up with or even surpass TSMC’s dominance in making the most sophisticated chips (<7nm).¹⁰

9. Shifts in the Taiwanese populace’s geopolitical stance

Polls show, and have shown for decades, that Taiwanese citizens prefer the status quo of de facto autonomy to either integrating with China or formally declaring independence, knowing the latter could trigger a PRC attack or invasion.¹¹ Polls also show that Taiwanese rate the United States more favorably than China by a two-to-one margin. That said, Taiwan’s Democratic Progressive Party (DPP) has, since its

founding in 1986, leaned more toward independence. The Kuomintang Party, which ruled mainland China from 1927 to 1949, then considered itself mainland China's government in exile until the early 1990s, has shown more interest over time in improving relations with the PRC, even exploring ways China and Taiwan might merge on terms in Taiwan's interests. Changes in the ruling party over time, or within party platforms, could yield unexpected consequences.

10. Degree of scientific literacy of US versus China population and leadership

Scientific literacy affects the quality of technology workforces as well as public attitudes toward policy. A Pew study suggests Americans' scientific literacy, while higher than China's, is not universal.¹² China's government is actively engaged in trying to increase scientific literacy among the general public.¹³

11. Quality of education and training in China to advance semiconductors and related technologies

Increasing innovation and technological advancement has been a high priority for Beijing for more than two decades. Semiconductors are a particular focus. China's government is investing heavily in education to expand its skilled workforce capable of advancing the semiconductor industry, a workforce that already increased from 512,000 employees in 2019 to 745,000 in 2022. See chapter 8 for more on China's semiconductor workforce.

12. Quality of education and training in the United States to advance semiconductors and related technologies

Expanding and improving the US STEM (science, technology, engineering, mathematics) workforce would enable the United States to more effectively compete globally in key technologies, including semiconductors. The CHIPS Act's provisions could help. See chapters 3 and 4 for additional discussion on US semiconductor workforce development.¹⁴

13. Degree of secular shift in semiconductor demand patterns

Semiconductor fabrication can boom or bust, prompting manufacturers to deploy capital conservatively even when faced with high levels of demand. Demand from new classes of technologies or consumer applications could change that pattern, mitigating risk.¹⁵

14. Degree of the United States' and its partners' reliance on China's supply chains for strategic "green" technologies

China has outsized influence over the global supply chain for green energy infrastructure such as electric vehicles and solar panels, as well as for rare earths and other critical minerals used in clean energy infrastructure, such as lithium for rechargeable batteries.¹⁶ New dependence on China in one priority technology field may affect US leverage in another, such as semiconductors.

15. Level of and response to tariffs, sanctions, or export restrictions by Washington or Beijing

China's public diplomatic response to the US Department of Commerce's October 2022 semiconductor technology export controls—instituted during a sensitive time of domestic economic stagnation, brewing zero-COVID policy discontent, and the 20th National Congress of the Chinese Communist Party, during which General Secretary Xi was appointed to an unprecedented third term—was initially muted, with a focus on redoubled domestic semiconductor industry subsidy within China to accelerate efforts toward autonomy. It is possible, however, that future export controls could provoke broad retaliatory trade measures by Beijing against the United States, or punitive actions toward specific US firms.

16. Possibility of leadership change or struggles in China, causing a sudden change in direction of China's foreign policy

Some of China's biggest political changes were not ones outsiders, or even many Chinese citizens, saw coming. Among plausible futures are these:

- General Secretary Xi stays in power throughout the next decade and continues on the same course.

- Xi stays in power but changes course in ways that make potential global leadership from China more acceptable or even attractive to many countries.
- Xi is replaced by either a leader or group of leaders who want to return to the trajectory of the “reform opening-up” era, or by leaders as ambitious as, or more ambitious and aggressive than, Xi.

Our Scenarios

Our scenario planning yielded four plausible futures about how that challenge may play out over the next decade (figure 1.3). These four quadrants are formed by two axes, the vertical one representing technology and innovation and the horizontal one representing the global economy.

The right two quadrants—the “east,” borrowing from the directions on a compass—are futures with a more open global economy and freer flows of trade and innovation. The left two quadrants—the “west”—are futures with blocs or networks largely trading with other participants within the same bloc. The western quadrants are more turbulent, the eastern ones more peaceful, though with different powers leading.

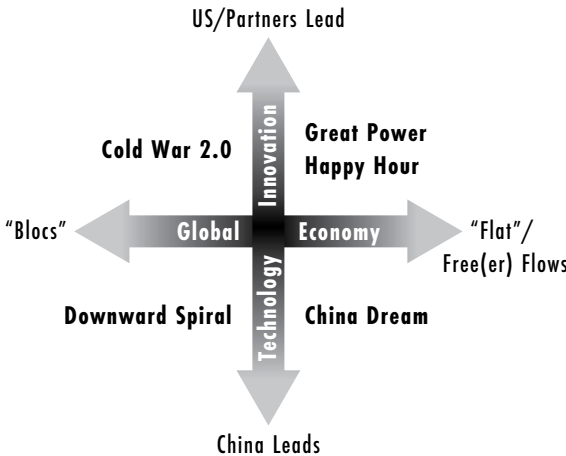


Figure 1.3. Our Scenarios Situated within Four Quadrants

The upper two quadrants—the “north”—are futures in which the United States and its allies lead in technology and innovation in strategically important spheres, including semiconductors. The lower two quadrants—the “south”—are futures in which China leads.

Again, the idea was not to make predictions, but to represent different plausible futures, recognizing that the actual future will likely be some mix of all of these scenarios, or may move from one of these scenarios to another.

Scenario No. 1 for 2032: “Cold War 2.0” (NW)

This is a future of trade blocs, perhaps dividing closed versus open societies, in which trading occurs especially within blocs. The two blocs here are led by the United States and China, though other networks may also emerge. Trade across blocs survives, but is more difficult and expensive. Nonaligned countries can trade with more than one network or shift among them, while protecting their own national interests as best they can.

The United States and its allies or close partners compete on their democratic and free-market values. China competes on its mercantilist willingness to trade with and invest in anyone, including via its Belt and Road Initiative (BRI) network. Neither China’s leadership nor its approach has fundamentally changed from a decade earlier.

Geopolitical

US-China tensions increase as the two sides pull away from each other while maintaining a “war-readiness” footing. Fear of war in or around Taiwan or the South China Sea has risen, with US and regional concerns that China may try to take some islands or blockade Taiwan. China doesn’t seize control of Taiwan, but does continue to act aggressively toward it. The United States, while still adhering to its “One China” policy, increasingly promotes Taiwan as a member of the international economic community.

Global institutions such as the United Nations and the World Trade Organization become sclerotic venues for episodic horse

trading, after years of China increasing its influence in such organizations and insisting the now-China-dominated UN serve as a sort of “global government.” In reaction, the United States and its allies rely increasingly on their own direct relationships with individual countries and with regional groupings, such as the Association of Southeast Asian Nations (ASEAN).

Global Trade/Investment

The United States and its allies continue rules-based trade, with economies that are “strong-ish”—healthy, but with increased defense spending. China doesn’t accept many of those rules, and dueling standards and practices emerge. As the decade proceeds, nonaligned countries face growing pressure to choose sides.

China’s economy is challenged, as some of its former top trading partners—the United States, the European Union, and Japan—have cut back their trade with China. China’s trade with BRI partners does not make up the difference. China’s digital RMB (renminbi/yuan) emerges as a clearing currency used within China’s bloc, giving authoritarian governments a way to ease the bite of dollar-denominated sanctions imposed by the United States and its allies.

Technology and Semiconductors

The topography of the US and allied semiconductor industry has changed, with manufacturing and the supply chain more distributed and robust, as are the underlying applied R&D that sustains semiconductors’ two-to three-year technology cycles. Taiwan remains important, but TSMC’s semiconductor production is more geographically diversified.

The United States and its allies prioritize creating or enhancing industrial policies, STEM education from K–12 onward, and research and development. Immigration reform in the United States and among close partners welcomes students, researchers, engineers, scientists, and entrepreneurs from around the world to contribute to a strengthening international STEM ecosystem.

The United States and allies take steps to ensure access to raw materials and minerals needed for semiconductors and other critical

technologies. China's state-led research and development efforts make some progress. But under increasingly centralized state control that squelches entrepreneurial energy and innovation, those efforts don't keep pace with the progress made by the United States and its partners. The United States and allies harden their defenses against intellectual property theft and espionage. China responds in kind, such as through international lawfare against US firms it accuses of incorporating China-origin technologies.

Scenario No. 2 for 2032: "Great-Power Happy Hour" (NE)

This future is a peaceful world marked by a return to a broadly integrated global economy and continued US and allied global leadership. That alliance is strengthened after the experience of coordinating sanctions against Russia in response to its invasion of Ukraine. Western liberal rules dominate, and the West keeps the tech lead—in part due to increased spending and focus on research and development and STEM education, especially related to semiconductors. The United States and its partners have created a robust semiconductor supply chain, and have an assured supply of semiconductors.

Geopolitical

The United States and its partners work well together, having overcome domestic divisions that had earlier impeded progress on policies. They now harmonize their individual national policies and share responsibilities on diplomatic, trade, and development policies. The United States listens more, is more involved, and is more inclusive. It still leads, but it wears its leadership mantle more lightly and acts like more of an equal partner. New partners, such as India, are integrated into this network, which is increasingly seen as more reliable and beneficial than any other.

Taiwan prospers, and its political status remains the same.

China stumbles. Global sentiment about China has turned more negative after years of its aggressive diplomacy and moves to support

contentious territorial claims, and its approaches to trade and investment that prove to be far from the “win-win” that China promised. China may have new leadership, or Xi Jinping may have decided—or may have been forced—to curtail China’s regional aggression and global ambitions.

US and allied defense spending remains robust, and extends to offering harder protections against espionage and intellectual property theft. But fewer military threats leads to funds being channeled into increased investment in education, industrial infrastructure, and the social safety net at home, as well as foreign investment and development aid abroad. These investments foster international goodwill and a desire to partner with the United States and its allies.

Global Trade/Investment

The United States and its allies’ coordinated efforts reinvigorate a global investment and trading regime rooted in “Western” liberal values, and strengthen US and partner economies. These economies become a magnet for international investment and talented immigrants.

Taiwan prospers, enhancing its status as a globally important hub of innovation and leading-edge manufacturing.

China’s economy is weaker. Its government’s ambitions have been hampered at home by a slowing economy and an aging population that draws resources from a shrinking workforce. The Party’s increased centralized control over the private sector has reduced innovation and entrepreneurial energy.

Internationally, China leads a bloc of lesser economies. Its Belt and Road Initiative network has shrunk in size and impact due to some countries deciding BRI membership in general, and certain investments by China in particular, are not in their national interests. Many such countries choose instead to “multialign,” picking and choosing relationships that suit different aspects of those national interests. The United States and its partners show superior power to attract those making such choices. China continues to participate in this US-dominant system, as it still needs export earnings and a “seat” from which to try to game or change the system.

Technology and Semiconductors

Export controls remain in effect and are better coordinated by the United States and its partners, including in standards bodies that govern different technological domains. As parity grows, a “Semiconductor Coordinating Council” formalizes those export controls, subsidies, and tax policies around semiconductors among the United States and its partners. Such coordination makes advanced partner countries feel comfortable selling to China, which remains a significant market and a good source of legacy semiconductors.

China’s decades of investment in research and development lead to technological advances that are useful and additive in this global system, including related to semiconductors, but do not put China in the lead and in a position to dominate it.

Scenario No. 3 for 2032: “Downward Spiral (in US-China Relations)” (SW)

This is a future in which China’s belief that the East is rising and the West is declining is borne out, but with significant friction. Mercantilist China outcompetes the United States and its allies. The BRI is working well in terms of China’s goal: creating a new network of global trade and power with China at the center, and assuring China’s access to the resources it needs and the strategic positioning in the Indo-Pacific and around the world it wants, especially in ports along strategic waterways and their choke points. This positioning increasingly challenges and erodes the US military’s counterbalancing role in the Indo-Pacific.

Geopolitical

The United States and its partners have responded to a rising and increasingly influential China by partially decoupling from it. They urge nonaligned countries to choose sides. Fewer and fewer do, resulting in a larger group of nonaligned states. ASEAN threatens to fracture under pressure from the United States and its partners on one side and from China on the other. For many ASEAN countries, arguments that

the US side upholds superior values don't carry the same weight as the economic benefits from China's investments.

The United States arrived here through missteps. Internal political polarization, prejudice, violence, xenophobia, and the erosion of US democracy and rule of law have weakened American soft power. Greater polarization of US political parties leads to sclerotic responses to domestic and global challenges and opportunities. Increasingly, other countries decide that US partnership is unreliable, and they need to find their own way forward.

China got here with consistent, reliable, pragmatic economic policies, including investment in infrastructure at home and abroad, and in military modernization. China increasingly treats the Indo-Pacific as its "backyard," leading to widespread regional resentment. China has taken aggressive action to bring Taiwan under PRC control, but is not getting the benefit China's leaders thought it would from that action due to resistance on the ground in Taiwan, international sanctions, and a substantial hit to China's already-ropey global image. The United States may have lost soft power, but China hasn't gained it. Rather, China takes the lead globally through pragmatic, mercantilist deal making, and coercion when necessary.

Global institutions are reduced to arenas of rivalry and grievance.

Global Trade/Investment

The world is divided into two main blocs—the United States and its partners in one and China in another—and by many nonaligned nations who themselves may have left existing regional groupings to form new, smaller blocs. These smaller blocs do their own negotiating and deal making with other blocs. Trading and investment are increasingly done within the two blocs, though some commerce continues between them. The reach of China's BRI is vast, but because the relationship between China and member states is so transactional, with a hub-and-spokes system that mostly benefits China, member states still look for opportunities elsewhere.

China's economy has surpassed that of the United States. China outcompetes the United States and its partners, offering acceptable quality and much better price points on exports, including technological exports.

China's RMB-denominated economy becomes an attractive destination for capital and, increasingly, reserves. Its digital RMB currency has proven popular, especially among authoritarian governments looking to avoid the bite of sanctions from the United States and its partners. The power of the dollar as a reserve and clearing currency has declined.

A lack of US investment in education, innovation, R&D, and infrastructure has taken its toll. US economic growth slows down, as does US innovation. In a weaker economy, the United States and its partners try to compete by lowering prices, offering subsidies, and protecting intellectual property—all of which lower returns.

Technology and Semiconductors

China reaps the benefits of its decades-long investments in education, innovation, and research and development, as well as with canny acquisition of companies and intellectual property—both legal and extralegal.

China has become largely self-sufficient in many key technologies, and edges out the United States and its partners in exporting those technologies around the world, especially to BRI member states. China's self-sufficiency and dominance allow it to gather, analyze, and centralize ever more data from around the world, including data related to the movement of ships and cargo, thanks to China's presence in the dozens of seaports China's companies now own or manage, to better calibrate its strategic policies and political messaging.

Divergent standards arise for many technologies, as China develops and exports its own. China's voice in international standards-setting bodies has grown more prominent, even dominant.

China has attained the capability to make its own leading-edge semiconductors, so it doesn't need TSMC to get ahead. China's seizure of Taiwan has, in any case, diminished TSMC, with its workforce having scattered, some now working at other TSMC semiconductor foundries abroad and some at Samsung or Intel, which have stepped up as the new leading-edge semiconductor manufacturers.

China continues to dominate as a global source of legacy semiconductors, needed in everything from automobiles to military equipment.

China uses this leverage as a policy tool, often to the detriment of the United States and its allies.

China also maintains a near monopoly on rare earths and critical materials needed for semiconductors and other technologies. And China makes muscular use of this leverage, suspending or cutting off supply when aggrieved by a recipient country's actions.

Meanwhile, US internal political divisions make it hard for Congress to pass legislation on immigration reform or to increase spending on education and R&D, and private companies prefer to chase short-term gains rather than invest in R&D. Divergent standards, patchy access to raw materials, and a lack of foresight and investment in the future contribute to the United States falling behind China as technological leader.

Scenario No. 4 for 2032: The China Dream (SE)

In this future, China leads a free and more integrated international system where global stability is sustained with relatively few kinetic conflicts. Global institutions matter more, and China is at their helm. China has softened its positions on a variety of fronts, and changed its image enough that more people have made peace with being part of this system. China is now firmly in the lead in most technologies, including semiconductors. China has become the preferred destination for talented immigrants and investment. Trade is RMB-denominated. China is doing better than before at the soft-power game, having learned that reliable, beneficial partnership works better than “wolf warrior” diplomacy and coercion.

One possibility in this quadrant is that leadership in China has changed, and its new leaders are committed to making China a responsible stakeholder. Alternatively, China's current leadership may still be in power, and has found pragmatic ways to maintain a system that supports US and partner interests enough that they accept China's leading role, even as the United States and partners continue to protect and promote their interests.

The United States and its allies fail to outcompete China, economically or in terms of values, as US internal divisions and strife are out of sync with purported US democratic values. The US economy is in

decent shape, but weaker than China's. The US dollar reserve status is effectively gone. The United States and its partners get a share of the pie, but not the biggest.

Geopolitical

This is a relatively peaceful world in which trade, not values, is the balm. Global institutions are more important, and China exercises significant influence over many of them. The United States and its allies resist, but those efforts are not particularly effective since the differences between their values and China's—as reflected by actions, not just words—are now less pronounced.

Taiwan has voluntarily become part of the People's Republic of China, after a Kuomintang Party victory leads to negotiations and an agreement with China that KMT leaders find to be in Taiwan's interests. Driving “unification” is a pragmatism that takes into account the powerful economic incentives offered by China and an acceptance of new realities—both China's dominance in the region and the lack of ability or willingness of the United States and its partners to protect Taiwan. Taiwan's population accepts this change as the best possible choice, and Taiwan's economy thrives.

Global Trade/Investment

China moves up the value chain, and is now a major global player in innovation, leading-edge technology, services, finance, and manufacturing. Global trade flows more freely, is quite transactional, and is RMB-denominated. Global standards and norms have been “harmonized” to predominantly reflect China's preferences. Some trade networks and bilateral trade agreements survive, but their rules are updated to reflect the new “language” of trade under China's leadership. China's stock exchanges are now where the action happens. China's financial firms are the leading deal makers, increasing China's global economic dominance.

The United States and its allies do comfortably well in this future economically, but they are passengers on the bus. They no longer lead in setting standards and norms, including trade rules, and they no longer benefit from the US dollar being the reserve currency and currency

of record. Depending on whether prevailing domestic political winds at the time are isolationist or support a greater US role in the world, the United States and its partners may scheme to get back on top. Or—if led by a nationalistic, xenophobic, and protectionist government—the United States may decide that this is good enough, and in any case is better than spending time and money on improving America’s place in the world, much less reclaiming a role of global leadership.

Technology and Semiconductors

China is firmly in the lead—with Taiwan and TSMC now working with it—in the design and manufacturing of most of the important technologies, including semiconductors. Global supply chains shift to reflect China’s dominance. Meanwhile, China’s famously efficient domestic supply chain networks feeding the tech sector become even more robust.

China is now fully in control of global technological standards bodies, including those related to semiconductors. Standards now more strongly benefit China’s domestic capacities and support China’s industrial and technological priorities.

The United States and its partners continue to fabricate semiconductors—perhaps now dependent on continued government subsidies, given the loss of technological edge to support profitability. But having lost their lead in innovation and design, they are increasingly dependent on China for advanced chips. China uses as leverage its near monopoly on critical minerals and raw materials essential for tech manufacturing, squeezing supply to reduce the chances that the United States and its partners can catch up. Having squandered the chance to invest in education, R&D, and immigration reform, the United States and its partners increasingly do what China did on its way up: reverse engineer designs and technologies and acquire companies and their IP, rather than create them.

The US and partner militaries are particularly challenged, not only in keeping up with China’s high-tech weapons, surveillance, and cyber warfare systems, but also in having the legacy semiconductors they need for their existing weapons systems. US military positions and mandates need to be reconsidered, especially in the Indo-Pacific, where China makes it clear—through use of its economic, trade, and supply chain leverage—that a US military presence is no longer welcome.

Probable and Preferable Scenarios and Dynamics

Scenario planning encourages robust thinking about all plausible futures that matter to the group. In a ten-year time frame, elements of some or all of these scenarios may become reality, so action is needed now to prepare for any combination of them.

Having built a map of plausible futures, our scenarios team next began to speculate about which outcome seemed most likely, and which future would be most preferable for US interests.

We began work on our scenarios in early 2022. Since then, the forces that were leaning toward a more fragmented “bloc”-like future were amplified by Russia’s invasion of Ukraine and by the coordinated US and allied response to it.

While the scenario team feels that all four scenarios are plausible in our ten-year time frame, the participants believe that it’s all but certain that at least the early years of the decade will head west on our grid, toward Cold War 2.0 (NW) or Downward Spiral (SW)—a turbulent and confrontational future in which geopolitics may dominate (figure 1.4).

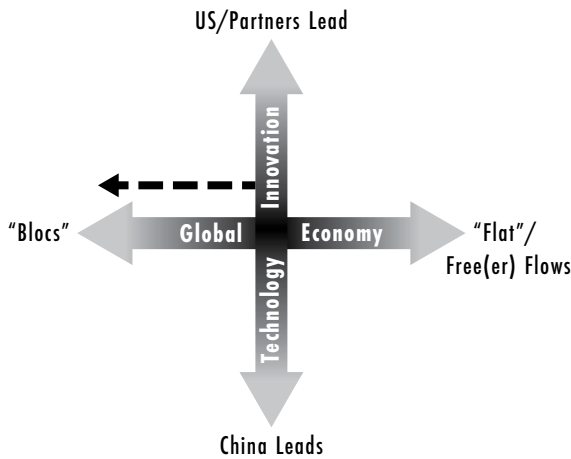


Figure 1.4. Westward Prevailing Current

The scenario subgroup also considered which “prevailing currents” could move us into particular quadrants. Among those they thought more likely than others are the following:

1. As shown in figure 1.5, the United States and its partners build on their cooperation in response to Russia’s aggression, driving the world first into the northwest quadrant, then (via success in enlisting nonaligned countries, and the “benefit” of China’s troubles) over to the northeast.

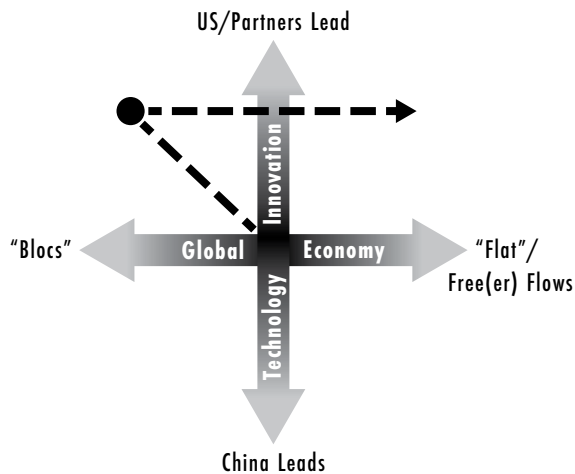


Figure 1.5. Flowing to Cold War 2.0 (NW), Then Great-Power Happy Hour (NE)

2. China succeeds in navigating the current politically fraught moment—which diverts US attention and assets away from the Indo-Pacific—and manages to move the world toward the Downward Spiral (SW). Then, confident enough in their position to begin to “liberalize with Chinese characteristics,” they build on their trading and financial momentum to move the world to the China Dream (SE), as in figure 1.6.

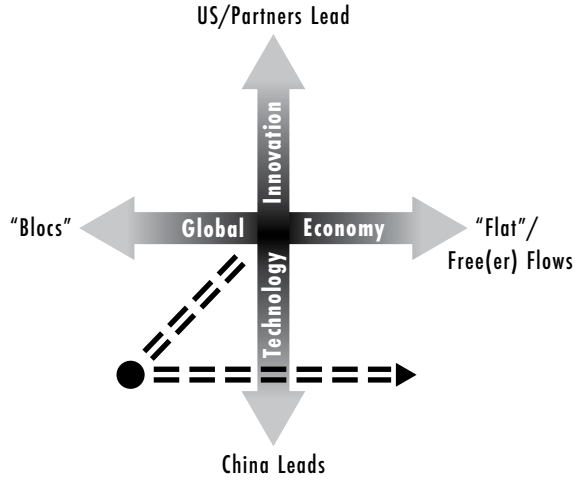


Figure 1.6. Flowing to Downward Spiral (SW), Then China Dream (SE)

- 3. As in figure 1.7, we “stall” in one of the western quadrants for the entire decade leading to 2032.

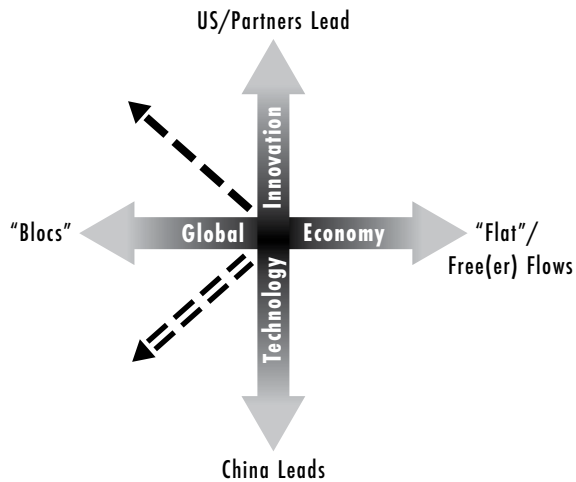


Figure 1.7. Flowing to West, Then Stalling

- 4. The United States and partners begin in a leadership role in Cold War 2.0 (NW), but falter for their own reasons, and/or are out-competed by China. The world slides into Downward Spiral (SW). Or, China is able to move the world to the southwest, but is either outcompeted or falters, and the world moves into Cold War 2.0 (NW), with the United States and its allies again in the lead, as in figure 1.8.

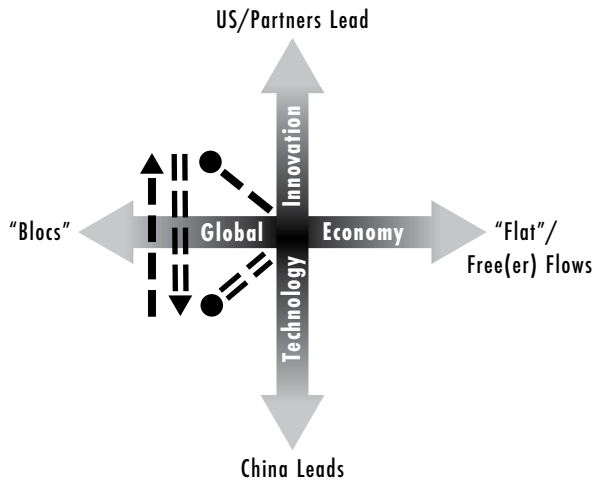


Figure 1.8. Flowing to West, Then Dynamic Struggle

Some in the group felt that the China Dream (SE) scenario, which is peaceful but with China leading, is the least preferable for US interests, since even the more turbulent Downward Spiral (SE) quadrant offered more possibilities for the United States to work its way back into a global leadership role. That said, many developing countries that simply want to prosper and protect their own interests may care more about whether the world as a whole is peaceful and stable, and less about who is leading the global system—so long as the leader doesn't try to impose its ideology or values, and isn't unduly coercive, predatory, or unfair.

A US failure to see this possibility—perhaps due to domestic political polarization and turbulence—is exactly what could lead to a China Dream (SE) future. Indeed, US polarization could lead many around the world to give up on US leadership, reasoning that it is effective only in episodic stretches, and ineffective and even destructive at other times.

Scenario Implications and Principles

Our scenarios team worked from scenario-specific implications (“if we knew for certain that this future was going to unfold over the next decade, we should do . . .”) to create high-level recommendations for actions that are robust across all scenarios. These recommendations either make great sense in each scenario or are important in some but do no harm in the others, maximizing the possibility of desired outcomes for the United States and its partners. The team also identified actions in some scenarios that would be ineffectual at best or counterproductive or harmful at worst.

When scenario-planning exercises are done with governments, corporations, NGOs, and similar groups, much time is spent on contingent implications. The group then empanels early warning teams that spend the next several years watching for indicators that show contingent implications playing out, so the team can alert the organization to take appropriate action. Our working group, however, is a temporary convening of experts and specialists—meaning it won’t be around to monitor emerging contingent implications. But we hope you, as a reader, do keep these in mind as the next decade unfolds, and that relevant US government departments, companies, and other potentially impacted organizations do the same.

What follows instead are “robust” implications and principles—the kind that make sense, or at least don’t do harm, in each future the group imagined. These high-level implications reflect the group’s thoughts on how the United States and its partners can continue to lead in a rules-based global order with a resilient supply chain for semiconductors and other critical technologies. They also include precautions to ensure the

United States and its partners are well positioned to respond to any of the scenarios—open to opportunities, hedged against risks.

Foreign Policy Principles

- Strengthen US relations with allies and friends. Listen well and pursue policies that work for them as well as for the United States.
- Communicate context. Explain where we are in these scenarios, and why the United States is acting, or proposing to act, as we are.
- Stay involved, and in some cases become more involved, in international organizations to better influence decisions. Continue to invest in leadership in organizations with global reach, such as the United Nations—but prioritize partner groupings and multi-lateral structures such as the G7 and ASEAN.
- Prioritize efforts to enlarge our circle of allies and friends:
 - Build on the Partnership for Global Infrastructure and Investment as an alternative to China’s BRI offered by the United States and its allies.
 - Make judicious use of export controls, aimed almost exclusively at China and its authoritarian partners, while guarding against unintended consequences that may weaken US and partner technology leadership in the private sector.
 - Increase soft-power efforts to highlight our values, including the strength of democracy and resilient institutions. And then walk the talk.
- Promote Taiwan as a full member of the world economic community, stopping short of insisting on sovereignty. Support Taiwan’s economy and its self-defense efforts and encourage people-to-people ties across business and civil society.
- Strengthen diplomatic ties with countries rich in key semiconductor raw materials.
- Rebuild the US Foreign Service by enhancing recruitment and training efforts, and by more quickly confirming ambassadors and other important foreign policy-related appointments.

Defense Policy Principles

- Increase investment in and licensing of advanced technologies in ways that benefit US and partners' militaries and economies.
- Broaden the array of semiconductor suppliers, shifting from a "trusted foundry" approach to "trusted assurance."
- Boost US naval presence in the Indo-Pacific. Prioritize deterrence.
- Actively help Taiwan build a "porcupine" posture to deter any attempted invasion, through these measures:
 - Selling arms and material, emphasizing coproduction of a "large number of small things"
 - Expanding joint training and planning
 - Hardening supply lines and stockpiles
 - Encouraging Taiwan to more rapidly pursue resilient energy supplies and infrastructure

Economic Policy Principles

- Play the long game: look for "win-win" policies and trade agreements, including through market access to allies and partners. Build those policies to be robust against possible decoupling from China.
- Strengthen the dollar as the clearing and reserve currency:
 - Create a fiat e-currency tied to the dollar.
 - Work actively to accommodate nonaligned countries.
 - Discourage, including by penalizing, shifts from the dollar to the RMB as a trading and reserve currency.
- Increase government investment in R&D, including applied research. Extend industrial policy to support critical industries and sectors, including semiconductors. Collaborate with partners in this effort.
- Encourage the US private sector to increase R&D spending, providing tax incentives and subsidies.
- Rethink our current antitrust approach. Allow semiconductor companies—and champions in other important tech sectors—to achieve the scale necessary to support R&D and competitiveness.

Technology Policy Principles

- Develop resilient supply chains for key technologies, including semiconductors. Source critical materials and other inputs from reliable suppliers.
- Actively participate in global deliberations on standards and rules.
- Increase the amount of engineering-based R&D spending. Use “moonshot challenges” to prioritize and create competition for key semiconductor and technology objectives.
- Increase investment in STEM education, including in K–12 as well as higher education, and workforce training.
- Encourage academic collaboration throughout US and partner trade and technology networks.
- Enact immigration policies that encourage talented students, scientists, and engineers to learn, research, and work in the United States. Ensure that the United States remains the most attractive global destination for such talent, alongside efforts to evaluate and improve the security of its research environment.
- Improve the manufacturing business environment within the United States and partner nations.
- Harden cyber defenses.
- Develop a safe and fair way to share US intellectual property with partners who can leverage it in our interests.

Semiconductor Supply Chain Priorities

- Emphasize resilience and robustness, stressing effectiveness and not just efficiency. Coordinate with partners to create policies, and make investments to encourage these outcomes:
 - Enhanced domestic manufacturing capacity
 - Extended commercial inventories of needed chip inputs, including legacy chips
 - A sufficiently skilled semiconductor workforce
- Build a semiconductor equivalent of the US Department of Energy’s Energy Information Administration (EIA) to collect and

share information on the semiconductor global supply chain. Encourage participation from companies receiving government advantages such as orders, subsidies, or tax breaks.

- Work with US partners to implement the following:
 - Create a diverse network in the Global South for lower-margin parts of the supply chain.
 - Create incentives to encourage some refining and processing of critical materials within the United States or in trusted partner nations, and cultivate technologies and practices that minimize environmental impact.
 - Consider discouraging use of semiconductor inputs or services sourced from China.
 - Block advanced chips and chipmaking tools from going to China or its close partners.
- Recognize that domestic manufacturing has to be accompanied by simultaneous R&D investments to sustain production at the leading edge beyond a two- to three-year technology cycle.

The following chapters in this report unpack many of these general implications within the context of the “silicon triangle”: reducing US vulnerabilities to semiconductor supply chain disruptions and increasing domestic competitiveness, all while enhancing Taiwan’s stability and prosperity; and simultaneously guarding against vulnerabilities as China further develops its own semiconductor industry and other advanced technologies.

NOTES

1. A January 26, 2022, *New York Times* article (Julian E. Barnes, “[How the Computer Chip Shortage Could Incite a US Conflict with China](#)”) and a December 27, 2021, Reuters investigation (Yimou Lee, Norihiko Shirouzu, and David Lague, “[Taiwan Chip Industry Emerges as Battlefield in US-China Showdown](#)”) speculate how disruption of Taiwan’s chip industry during a hostile conflict could disrupt the global chip supply chain and US economy.

2. A November 4, 2021, Voice of America article considered how B3W could interact with China's Belt and Road Initiative: Patsy Widakuswara, "['Build Back Better World': Biden's Counter to China's Belt and Road.](#)"
3. A February 2022 German Marshall Fund report considered a variety of avenues for EU-US cooperation on China: Andrew Small, Bonnie S. Glaser, and Garima Mohan, "[US-European Cooperation on China and the Indo-Pacific.](#)"
4. US Department of State, "[The Clean Network](#)," 2021.
5. National Science and Technology Council, Fast Track Action Subcommittee on Critical and Emerging Technologies, "[Critical and Emerging Technologies List Update](#)," February 2022.
6. Yifan Yu and Cheng Ting-Fang, "[TSMC in Arizona: Why Taiwan's Chip Titan Is Betting on the Desert](#)," *Nikkei Asia*, June 3, 2021.
7. TSMC and Sony Semiconductor Solutions, "[TSMC to Build Specialty Technology Fab in Japan with Sony Semiconductor Solutions as Minority Shareholder](#)," press release, November 9, 2021.
8. For more information about ASML's dominant market position, see this February 9, 2020, *Economist* article: "[How ASML Became Chipmaking's Biggest Monopoly.](#)"
9. For more information about how the COVID pandemic has accelerated regionalization, see this report from the Economist Intelligence Unit: "[The Great Unwinding: COVID-19 and the Regionalisation of Global Supply Chains](#)," 2020.
10. See this February 11, 2022, *South China Morning Post* article for more information about SMIC's efforts to close its gap with TSMC, including how SMIC plans to spend its record 2021 profit on capacity expansion: Che Pan, "[US-China Tech War: Top Chinese Chip Maker SMIC to Invest Record US\\$5 billion in Capacity Expansion after Profits Doubled in 2021.](#)" See also Dan Wang, "[The Quest for Semiconductor Sovereignty](#)," *Gavekal Dragonomics*, April 20, 2021.
11. Kat Devlin and Christine Huang, "[In Taiwan, Views of Mainland China Mostly Negative](#)," Pew Research Center, May 12, 2020.
12. Brian Kennedy and Meg Hefferon, "[What Americans Know about Science](#)," Pew Research Center, March 28, 2019.
13. For more information about China's scientific literacy, see this *China Daily* article: Zhang Zhihao, "[Scientific Literacy Plan Announced](#)," July 7, 2021. For more information about China's newest scientific literacy action plan, see this translation by the Center for Security and Emerging Technology (CSET): PRC State Council, "[State Council Notice on the Publication of the Outline of the Nationwide Scientific Literacy Action Plan \(2021–2035\)](#)," September 16, 2021.
14. For one perspective on the potential shortfall of semiconductor industry jobs in the United States, see this analysis from Eightfold AI: "[How the US Can Reshore](#)

the Semiconductor Industry,” 2021. For another, see this February 2022 report from the CSET: Will Hunt, “[Reshoring Chipmaking Capacity Requires High-Skilled Foreign Talent: Estimating the Labor Demand Generated by CHIPS Act Incentives.](#)”

15. As just one example, the global space industry is projected to grow to over \$1 trillion by 2040, up from \$350 billion in 2022. The most important short- and medium-term driver of this market growth is expected to be satellite broadband internet access provided by projects such as SpaceX’s Starlink constellation or Amazon’s Project Kuiper. See Morgan Stanley, “[Space: Investing in the Final Frontier](#),” July 24, 2020. Artificial intelligence compute is another.
16. A May 2021 International Energy Agency flagship report, as directed by IEA ministers, examined the role of critical materials in the clean energy supply chain. That issue was highlighted with a direction from ministers in the March 2022 meeting that IEA assume new responsibilities to consider the security of such minerals: “[The Role of Critical Minerals in Clean Energy Transitions.](#)” Following the US Department of Commerce’s October 2022 issuance of new export control and other rules targeting China’s semiconductor industry, for example, China announced its own controls on the export of ingot and wafer production technologies used in the manufacture of solar photovoltaic panels. See Nadya Yeh, “[China Drafts New Export Controls to Shore Up Solar Dominance](#),” *China Project*, February 1, 2023.



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Center on U.S.-China Relations