The Biden Administration's Scientific and Technological Competition Strategy toward China

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Abstract: Scientific and technological (S&T) competition has become a core and frontier issue in the ongoing China–U.S. strategic competition and the main focus of both countries. Currently, the Biden administration is adopting an S&T competition strategy toward China based on the "small yard, high fence" tactical logic, which involves three pillars: investment to make America strong, alignment to get things under control, and competition to weaken China. In the current context of the China–U.S. competition entering a new normal, five inherent contradictions, namely, the gap between strategic expectations and policy effects, shortfall between action capabilities and policy objectives, push-and-pull between strategic deployment and domestic politics, clash between strategic intentions and the S&T innovation ecosystem, and divergences between American priorities and the interests of American allies, will dictate how this administration will implement its S&T competition strategy toward China.

Keywords: scientific and technological competition, strategic competition, China–U.S. relations, Biden administration

Rapid scientific and technological (S&T) innovations will shape a country's national interests in all aspects. Moreover, the emergence of new technologies will affect the existing balance of economic and military

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strengths among major countries. Over recent years, S&T competition has become a core and frontier issue in the current China–U.S. strategic competition. During the four-year presidential term of Donald Trump, he implemented a series of strategies to suppress the rise of China in the S&T fields. Since taking office, Joe Biden has made several modifications to the U.S. foreign policy but basically inherited his predecessor's "strategic position and approach to China, while striving to formulate a competitive China strategy more beneficial and sustainable for the U.S."[1] Thus far, the Biden administration has not yet issued a special strategy report on the top-level design of the U.S. S&T competition against China. Nonetheless, its relevant measures and actions have de facto formed a systematic China strategy, whose contents can be found in policy documents such as the Assessment of the Critical Supply Chains, the Interim National Security Strategic Guidance (INSSG), the Declaration for the Future of the Internet (DFI), and the Indo–Pacific Economic Framework for Prosperity (IPEF).

On May 26, 2022, U.S. Secretary of State Antony J. Blinken delivered a speech entitled "The Administration's Approach to the People's Republic of China," in which he summed up the overall China strategy of the Biden administration in three words—invest, align, and compete. Blinken believes that increased investments in the foundations of U.S. strength at home and greater alignment with allies and partners will allow his country to better compete with China.[2] Compared to the previous China strategy based on competition, cooperation, and confrontation that had been frequently emphasized by members of this administration, the new strategic framework downplays the word "competition" but highlights the U.S. intentions to make itself strong and win over allies, which will afford it a higher position of strength, lower strategic costs, and a longer strategic cycle to restrict China. Based on Biden's new approach, the U.S. S&T competition strategy toward China will focus on both "weakening China" and "strengthening America" in the long term. However, in practice, its focus will shift from "reducing China's S&T influence and retarding its S&T progress

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[1] Wu Xinbo, "Shaping the New Normal in China–U.S. Strategic Competition," *China International Studies*, No. 2 (2022): 37–50.

[2] Antony J. Blinken, "The Administration's Approach to the People's Republic of China," the State Department, May 26, 2022.

to the best possible extent" to "maximizing U.S. leadership in global S&T."

Strategic Logic

In the context of China–U.S. relations, Biden has inherited his predecessor's strategic position and basic policy approach toward China. However, in the context of S&T competition, this administration has modified the "complete decoupling" strategy that Trump advocated. As a representative of Washington's establishment, Biden has exhibited a more prudent and professional governance style.[1] Meanwhile, the incumbent China policy team is composed of veterans who are more experienced in dealing with China: some members of this team participated in the formulation and implementation of U.S. policy toward China during Barack Obama's term and witnessed the limitations of Trump's "complete decoupling" strategy.[2] Therefore, compared to his predecessor, Biden has appeared more sensitive to the boundary of China–U.S. S&T competition and the extent of the S&T decoupling between the two countries, thus adopting a "small yard, high fence" competition strategy against China.

The "small yard, high fence" was originally a military defense concept derived from the U.S. space defense strategy proposed by Obama's Secretary of Defense Robert Gates.[3] In October 2018, Lorand Laskai and Samm Sacks, two researchers from the New America think tank, introduced the concept to the U.S. strategy for its S&T competition with China. The so-called small yard refers to the technology fields that are of critical importance to U.S. national security and the so-called high fence refers to the strategic boundaries. On the one hand, the technologies and knowledge inside the "small yard" will be protected by the

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[1] Da Wei and Cai Hongyu, "China–U.S. Relations in the Perspective of the U.S. National Security Strategy: A 50-Year Review," *Journal of International Security Studies*, No. 2 (2022): 3–46.

[2] Fan Jishe, "American Strategic Adjustment toward China: Organizational Change in Decision-Making Mechanism and Generational Transition of Decision-Maker," *Contemporary American Review*, No. 4 (2021): 1–19.

[3] "The 'Small Courtyard' and 'High Wall' of the United States' Science and Technology Strategy toward China," accessed July 22, 2022, https://ycnews.com/the-small-courtyard-and-high-wall-of-the-united-states-science-and-technology-strategy-towards-china/.

"high fence" through the tight restrictions and review measures imposed against China. On the other hand, the technologies and knowledge outside the "small yard" can be subject to exchanges with China; in this case, the "high fence" will reduce the collateral damage caused by S&T decoupling inside the "small yard" to the strategic interactions between China and the U.S.[1] The Biden administration is adopting a strategy for S&T competition against China based on the concept of "small yard, high fence," which can be summarized as follows:

First, the Biden administration views S&T as a holistic lever for managing the China–U.S. strategic competition. Since 2018, the U.S. Congress has been debating over ambitious legislations one after another that are intended to serve the country's strategic competition against China. Nevertheless, the U.S. lacks a holistic tool to organize its discrete strategic objectives. Therefore, this administration is attempting to use S&T as a holistic lever to advance various policies and fulfill multiple objectives toward China. Its S&T policies include restraining China's rise in the S&T field through critical technology blockade and easing the strategic rift between China and the U.S. through constructive S&T engagement in climate governance. For example, in November 2021, the two countries issued a Joint Glasgow Declaration on Enhancing Climate Action in the 2020s during the 26th United Nations Climate Change Conference of the Parties and agreed to cooperate in the promotion, application, and deployment of clean technologies. Therefore, the U.S. S&T policies toward China are composed of overall competition and selective engagement.

Second, the Biden administration prefers to invest more energy and resources in maintaining America's long-term S&T competitiveness than in limiting China's S&T advance in the short term. This administration has pledged in the INSSG that it will "double down on science and technology investments, including in research and development (R&D), foundational computing technologies, and domestic leading-edge manufacturing, to enable the pursuit of numerous national strategic objectives."[2] In a report entitled "Securing 5G: A Way Forward in the U.S. and China Security Competition," the RAND Corpo-

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[1] Samm Sacks, "China: Challenges to U.S. Commerce," accessed July 22, 2022, https://www.commerce.senate.gov/services/files/7109ED0E-7D00-4DDC-998E-B99B-2D19449A.

[2] White House, "Interim National Security Strategic Guidance," March 2021.

ration has warned that weakening China cannot enhance the S&T strength of the U.S.; conversely, if the non-Chinese foreign companies, on which the U.S. relies, fail to effectively compete with their Chinese counterparts, the U.S. telecommunications supply chains will become even more vulnerable. Therefore, the RAND Corporation has advised the U.S. to increase its investments in key links of domestic supply chains to ensure a stable access to advanced, credible key products.[1] The Carnegie Endowment for International Peace (CEIP) issued a report entitled "U.S.–China Technological 'Decoupling': A Strategy and Policy Framework" in April 2022, arguing that technology restrictions should be used to give the U.S. enough time to invest in emerging technologies, preserve competitive opportunities, and ensure technological preeminence; they should not be the primary means but should be confined to a secondary, supporting role.[2]

Third, the Biden administration believes that clarifications should be made regarding in what aspects the U.S. should continue to engage China to avoid unexpected conflicts due to overreaching decoupling. In February 2021, Biden asserted in his speech on America's place in the world that his country will confront China's challenge and attack on security, economy, values, S&T, and global governance and be "ready to work with Beijing when it's in America's interest to do so."[3] Kurt Campbell, U.S. National Security Council Coordinator for the Indo–Pacific, and Jake Sullivan, U.S. National Security Advisor, co-authored an article entitled "Competition without Catastrophe: How America Can Both Challenge and Coexist with China," arguing that the U.S. needs a long-term competition strategy and should get prepared for the competition with China amidst long-term coexistence.[4] In addition, as a witness of Trump's "complete decoupling" strategy, Biden is better aware of the fact that the U.S. is incapable

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[1] Daniel Gonzales, et al., "Securing 5G: A Way Forward in the U.S. and China Security Competition," accessed July 22, 2022, https://www.rand.org/pubs/research_reports/RRA435-4.html.

[2] Jon Bateman, "U.S.–China Technological 'Decoupling': A Strategy and Policy Framework," accessed July 22, 2022, https://carnegieendowment.org/2022/04/25/u.s.-china-technological-decoupling-strategy-and-policy-framework-pub-86897.

[3] White House, "Remarks by President Biden on America's Place in the World," February 4, 2022.

[4] Kurt M. Campbell and Jake Sullivan, "Competition without Catastrophe: How America Can Both Challenge and Coexist with China," accessed July 22, 2022, https://www.foreignaffairs.com/articles/china/competition-with-china-without-catastrophe.

of competing with China while disregarding and disconnecting the interdependence between the two countries.

Fourth, the Biden administration advocates increased federal intervention in S&T markets and industries and believes that determining the key emerging technologies for investment priorities and assuming greater responsibilities in critical but high-risk R&D investments will lead or encourage enterprises to defend the overall national interests of the U.S. In April 2021, the U.S. Office of the Director of National Intelligence pointed out in its annual threat assessment that "China stands out as the primary strategic competitor to the U.S. because it has a well-resourced and comprehensive strategy to acquire and use technology to advance its national goals."[1] The Information Technology and Innovation Foundation has called on the U.S. government to replicate China's technology strategy toward more active policy interventions, arguing that free markets are not enough to sustain U.S. leadership in the S&T competition.[2] In a May 2022 report entitled "Reboot: Framework for a New American Industrial Policy," the Center for a New American Security proposed that the federal government should enhance its leading role to strengthen the U.S. manufacturing sector and S&T innovation services.[3] With regard to U.S. industrial policy, the Institute for China–America Studies proposed that the policy tools and lines of effort sought to be deployed by the Biden administration should include adjusting federal procurement preferences, leveraging federally funded innovation, investing in key strategic and high value-added manufacturing sectors, imposing selective import tariffs, and catalyzing private capital into advanced manufacturing via supportive federal tax credits.[4]

Fifth, the Biden administration tries to strengthen multilateral technology

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[1] Office of the Director of National Intelligence, "Annual Threat Assessment of the U.S. Intelligence Community," April 9, 2021.

[2] Robert Atkinson, "The U.S. Needs to Copy China's Tech Strategy to Remain the Top Economy in the World," accessed July 22, 2022, https://www.businessinsider.com/us-copy-china-tech-strategy-remain-top-world-economy-2019-11.

[3] Martijn Rasser, et al., "Reboot: Framework for a New American Industrial Policy," accessed July 22, 2022, https://www.cnas.org/publications/reports/reboot.

[4] Sourabh Gupta, "The Biden Administration's Emerging Approach on 'Strategic Industrial Policy' and Proposed Lines of Effort," accessed July 22, 2022, https://chinaus-icas.org/research/the-biden-administrations-emerging-approach-on-strategic-industrial-policy-and-proposed-lines-of-effort/.

alliances, a strategic advantage of the U.S. that is deemed "incomparable," to address the S&T competition against China in terms of restructuring supply chains, export controls for technology, foreign investment scrutiny, R&D investments, international accumulation of human capital, and standard setting of emerging technologies. Since inauguration, the Biden administration has made extensive contact with allies, partners, and relevant transnational corporations via mechanisms such as the Global Summit on Supply Chain Resilience; the U.S.–Mexico High-Level Economic Dialog; the IPEF; the Quadrilateral Security Dialog between the U.S., Japan, India, and Australia; the U.S.–EU Trade and Technology Council; the U.S. International Development Finance Corporation; and the Partnership for Global Infrastructure and Investment (PGII). It attempts to break the boundary between public and private sectors and between government and civil society to implement an S&T competition strategy against China wherein a "multilayered coalition" and a "latticework of alliances and partnerships" nest with each other.[1]

Action Framework

U.S. Secretary of State Blinken sees investment, alignment, and competition as the three pillars underlying the Biden administration's approach toward China, saying that by harnessing two key assets, namely, increased investments in the foundations of U.S. strength and greater alignment with allies and partners, the U.S. will "compete with China to defend our interests and build our vision for the future."[2] This indicates that addressing domestic issues remains the top priority of the Biden administration, followed by consolidating U.S. strategic relations with allies and partners and competing with China based on the position of strength and an external environment that contains China. In the context of S&T, the Biden administration's competition strategy toward China is based on an action framework characterized by investments to make America strong, alignment to get things under control, and competition to weaken China.

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[1] Zhao Minghao, "The Latticework of Alliances and Partnerships, the Multilayered Coalition and U.S. Indo–Pacific Strategy," *World Economics and Politics*, No. 6 (2022): 26–55.

[2] "The Administration's Approach to the People's Republic of China."

The first pillar is increased investments to enhance U.S. S&T competitiveness. The Biden administration is actively advocating and increasing domestic investments in the U.S. industrial base and S&T innovation capabilities to strengthen the U.S. technological reserve within the "small yard" and cultivate U.S. S&T strengths required by the long-term competition with China. Its actions involve two key elements.

The first element is to ameliorate U.S. domestic supply chains. Upon taking office, Biden announced his intention to build more resilient and secure supply chains in the U.S. to reduce the reliance on China or other single foreign source. In February 2021, Biden signed Executive Order 14017, directing National Security Advisor Jake Sullivan and White House Economic Advisor Brian Deese to coordinate different federal departments and agencies to assess vulnerabilities in critical supply chains using a whole-of-government approach. Moreover, the Biden administration is adopting a series of preferential measures to address the risk of disruptions to critical technologies and materials. For example, in terms of clean technologies, the U.S. Department of Energy will award US$7 billion from the Bipartisan Infrastructure Law to strengthen U.S. battery supply chains, including materials refining and production, batteries and battery packs manufacturing, and recycling. In terms of critical minerals, the U.S. Department of Defense awarded a US$35 million contract to MP Materials through its Industrial Base Analysis and Sustainment Program to support the construction of a full end-to-end permanent magnet supply chain in California. In terms of critical technologies and materials, the Biden administration has asked federal agencies, local governments, private sectors, educational institutions, and trade unions to collaborate in prioritizing investments in domestic advanced manufacturing and reduce reliance on overseas semiconductor supply chains.

The second element is to consolidate the U.S. base for S&T innovation. In October 2020, Biden pledged in his speech "Why America Must Lead Again" that he "will make investment in R&D a cornerstone" of his presidency and will increase investments in education and job skills.[1] In February 2022, the

[1] Joseph Biden, "Why America Must Lead Again—Rescuing U.S. Foreign Policy after Trump," *Foreign Affairs,* No.2 (2020): 64–76.

U.S. National Science and Technology Council released an updated list of critical and emerging technologies, identifying the technology areas that require preferential and priority investments. In April 2022, the Office of Science and Technology Policy submitted an assessment report on the Industries of the Future Act and proposed the catalog of "future industries" that support innovative, inclusive, equitable, and sustainable growth based on the categories included in the list of critical and emerging technologies. The Biden Administration's Fiscal Year (FY) 2023 Budget also identified the strengthening of S&T innovation base as a pressing priority for the country. As a result, the Budget proposed a total spending of US$205 billion for federal R&D, a 28% increase over FY 2021, with US$111 billion allocated to basic and applied research and US$2.86 billion allocated to science, technology, engineering, and mathematics (STEM) education and engagement.[1] In addition, the Biden administration has proposed easing policies on skilled immigrants to fill the current talent shortage affecting the U.S. R&D. In February 2021, Senator Bob Menendez and Representative Linda Sanchez, both Democrats, introduced the U.S. Citizenship Act of 2021 in the Senate and in the House, respectively. This is a general immigration bill supported by the Biden administration that intends to make it easier for graduates of U.S. universities with advanced STEM degrees to stay in the U.S.

The second pillar is aligning with allies to create a competitive environment. The Biden administration is working to rally U.S. allies and partners to create an S&T competition environment where they can gain the competitive edge against China in terms of strength, system, and values. The purpose is to build more controllable "high fence" and achieve collective competitive advantages.

On the one hand, the U.S. has to reduce the risk of disruptions to international supply chains. The country objectively lacks the ability to control or produce all S&T items, nor can it bear the costs of developing all critical and emerging technologies, no matter how much effort the U.S. exerts to increase investments in its advanced industries. Therefore, it relies on foreign supplies for a considerable part of technologies and materials. The Biden administration has identified transparency, diversity, security, and sustainability as the

[1] White House, "The Biden–Harris Administration FY 2023 Budget Makes Historic Investments in Science and Technology," April 5, 2022.

four key pillars of global supply chain resilience.[1] The so-called transparency demonstrates the Biden administration's intention to acquire more information regarding the supply chains of U.S. allies and partners, including access to raw materials, inventory of intermediate and finished products, production capacity, sales, and customer information. In September 2021, the U.S. Department of Commerce (DOC) asked all parts of the semiconductor supply chain, namely, producers, consumers, and intermediaries, to "voluntarily" share information regarding their inventories, demand, and delivery dynamics. The so-called diversity clarifies the Biden administration's intent to reduce trade restrictions among allies and partners to diversify supply chains and avoid severe economic vulnerabilities emerging from a single source of critical materials and items. The Biden administration deems "security" as a high priority for all players within the international supply chains, which demands collaboration to prevent damage or disruptions that interfere with critical systems or infrastructure, or contribute to unnecessary costs and loss of intellectual property. With regard to "sustainability," the Biden administration focuses on establishing public–private partnerships to improve labor conditions, develop clean technologies, and promote global governance to contribute to the sustainable development of supply chains between the U.S. and its allies and partners. In a briefing in June 2022, the Biden administration pledged to execute the PGII across such priority pillars over the next five years as clean energy supply chains, information and communications technology (ICT) networks and infrastructure, essential medical product manufacturing, and disease surveillance and early warning.[2]

On the other hand, the U.S. aims to form a high-technology alliance against China. In the present context of a new round of global S&T revolution and industrial transformations, the Biden administration is attempting to create a hierarchical, exclusive international supply chain system by leveraging U.S. strengths in science, technology, and values empowered by collective competition against China based on the "latticework of alliances and partnerships" and "multilayered coalition" of the U.S. Through collective sanction measures, such

[1] White House, "Chair's Statement on Principles for Supply Chain Resilience," October 31, 2021.

[2] White House, "Fact Sheet: President Biden and G7 Leaders Formally Launch the Partnership for Global Infrastructure and Investment," June 26, 2022.

as export controls and investment restrictions that are mutually cooperating, the Biden administration aims to remove Chinese firms from the global market and innovation ecosystem of critical technologies. In April 2022, the Biden administration launched the DFI, urging that to "promote trust in the global digital ecosystem," the U.S. and its allies and partners should "promote and use trustworthy network infrastructure and services suppliers, relying on risk-based assessments that include technical and non-technical factors for network security."[1] Therefore, the "techno-authoritarian countries" defined by the U.S. should not be allowed access to the domestic markets of the signatories to the DFI. In June 2022, the Biden administration issued a statement after the Group of Seven (G7) summit, saying that the G7 will commit to a unified approach to address China's unfair economic practices and represent the shared "democratic" values in the S&T competition with China. Apart from excluding technology products of and restricting technology transactions with Chinese firms, the U.S. is working with its allies and partners to marginalize China in rules on cross-border data flows. They dub China as an untrusted country for data exchange, planning to establish a set of new data transfer rules that bypass and exclude Chinese firms beyond the framework of the Asia-Pacific Economic Cooperation Cross Border Privacy Rules.

The third pillar is a competition with China to advance a targeted decoupling. The U.S. "competition" with China is in nature a "decoupling" strategy intended to block the rise of China in S&T. In July 2021, Chinese Vice Foreign Minister Xie Feng said during talks with visiting U.S. Deputy Secretary of State Wendy Sherman that the "competition, cooperation, and confrontation" rhetoric by the U.S. side is in essence a thinly veiled attempt to restrict and suppress China. The real emphasis is on confrontation and containment; cooperation is just expediency, and competition is a narrative trap.[2] The so-called S&T competition with China is essentially an attempt to impose decoupling, supply disruption, and blockade or sanctions against China in areas where the U.S. prevails.

In terms of "small yard" technologies that relate closely with U.S. national

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[1] White House, "A Declaration for the Future of the Internet," April 2022.

[2] "Vice Foreign Minister Xie Feng Meets with U.S. Deputy Secretary of State Wendy Sherman," accessed July 18, 2022, http://new.fmprc.gov.cn/web/wjb_673085/zygy_673101/XF/xgxw_673105/202107/t20210726_9184812.shtml.

security, Biden has basically inherited his predecessor's policy tools for S&T decoupling. He has continued to pressurize high-technology firms from China through export controls, investment restrictions, import restrictions, restrictions on technology transactions, revocation of operating licenses, and restrictions on federal usage and expenditure. In April 2021, the DOC's Bureau of Industry and Security (BIS) added seven Chinese supercomputer firms to its Entity List for "conducting activities that are contrary to the national security or foreign policy interests of the United States." In June 2021, the U.S. Department of the Treasury's Office of Foreign Assets Control listed 59 Chinese firms on its new Non-SDN Chinese Military–Industrial Complex Companies List, prohibiting U.S. persons from being the holders or beneficiaries of the securities of those entities. In March 2022, the Federal Communications Commission (FCC) revoked authorization for Chinese telecom firm Pacific Networks and its fully owned subsidiary ComNet to provide telecommunications services in America for "potential espionage and data theft." In June 2022, the BIS included other 25 Chinese firms on its Entity List. In July 2022, the U.S. expanded export controls on semiconductor-making equipment, preventing Chinese firms from acquiring tools for 14 nanometer and more advanced chips. On September 1, 2022, U.S. officials requested U.S. chip designer Nvidia to stop exporting two top GPUs (A100 and H100) to China.

However, in terms of technologies outside the "small yard," the Biden administration allows suppliers to conduct technology transactions with Chinese firms by easing relevant restrictions. In August 2021, the U.S. granted licenses authorizing suppliers to sell chips to Huawei for vehicle components such as video screens and sensors. Meanwhile, the Biden administration has reduced import tariffs on technology products that the U.S. cannot produce domestically and must rely on China for supplies. In February 2022, in a joint report "Assessment of the Critical Supply Chains Supporting the U.S. Information and Communications Technology Industry," the DOC and the U.S. Department of Homeland Security pointed out that the production of several products, such as printed circuit boards, fiber optic cables, displays, and switches, has become increasingly concentrated in China. A combination of low profit margins, labor shortages, and insufficient industrial supporting infrastructure has eliminated manufacturing conditions in the U.S., forcing the country to rely on Chinese

supply chains.[1] Not long afterward, the abovementioned ICT products, which the U.S. cannot produce domestically, appeared in the list released by the Office of the U.S. Trade Representative in March 2022 of 352 reinstated product exclusions from tariffs imposed on Chinese imports. Evidently, for all Biden's efforts to increase pressure on critical technologies and relevant high-technology industries from China, compared with his predecessor, he has adopted more targeted and limited decoupling measures in terms of the S&T competition strategy toward China, thereby relatively reducing the range of influence of the China–U.S. S&T competition.

Practical Prospects

If we were to delve deeper into history, we would find that the U.S. won the S&T competition with the Soviet Union and Japan due to its national innovation system, which had laid a favorable foundation for its high technologies and relevant industries. This had created a synergy at both national and international levels to suppress the predominance of U.S. rivals in S&T in collaboration with various restrictive measures.[2] Currently, against China, "America's most strategic competitor," the Biden administration still uses the strategy relying on America's alliance system to achieve collective competitive advantages while increasing investments domestically in critical supply chains and S&T innovation bases toward a final victory in the long-term competition. The practical prospects of Biden's S&T competition strategy toward China do not depend on its specific designs or tactical choices but rather on the restraining factors awaiting his policies and measures in reality. In particular, the Biden administration will have to overcome the following five contradictions.

The first contradiction is the gap between strategic expectations and policy effects. It is true that the various kinds of measures the U.S. has imposed

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[1] U.S. Department of Commerce and U.S. Department of Homeland Security, "Assessment of the Critical Supply Chains Supporting the U.S. Information and Communications Technology Industry," February 24, 2022.

[2] Lin Xianlan, "Techno-Nationalism and the High-Tech Containment of the United States against the Soviet Union and Japan," *World Economics and Politics*, No. 12 (2021): 130–154.

against China, including export controls, transaction restrictions, and investment reviews, have significantly affected China's S&T development. However, holistically speaking, neither Trump's "complete decoupling" nor Biden's "small yard, high fence" has achieved what the U.S. expects in terms of policy effects. Since the U.S. launched the strategic competition, China has moved up—not down—in world ranking based on economic innovation capabilities and output. The Global Innovation Index published by the World Intellectual Property Organization shows that China ranked 12 in 2021, an increase from 17 in 2018 and 14 in both 2019 and 2020.[1] All the measures the U.S. has taken to suppress China in the S&T fields have increased the costs of S&T innovation for China and slowed its pace of S&T advancement but have not restrained the trend of its transcendence.

The second contradiction is the shortfall between action capabilities and policy objectives. The CEIP proposed nine policy objectives for S&T competition in its report, which include maintaining a military edge over China, limiting Chinese influence operations, and preventing so-called Chinese sabotage.[2] In general, the U.S. is exhibiting stronger strategic initiative in its relations with China, but this does not imply it has consistent capacities to achieve all policy objectives. In terms of S&T competition, the capabilities of the U.S. to endure losses, invest funds, and preserve resources vary on different issues. For example, in February 2022, Chairwoman of the FCC Jessica Rosenworcel notified the Congress that providers had initially requested approximately US$5.6 billion to cover the costs of removing, replacing, and disposing "insecure" communications equipment and services in U.S. networks produced or provided by Huawei and ZTE. This amount far exceeds the previous US$1.9 billion budget.[3] Surely, the U.S. surpasses China in terms of overall strength. Nevertheless, it does not have enough strength to realize its strategic intentions on all matters concerning S&T competition with China.

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[1] "Global Innovation Index," accessed July 18, 2022, https://www.wipo.int/global_innovation_index/en/2020/.

[2] "U.S.–China Technological 'Decoupling': A Strategy and Policy Framework."

[3] "Rosenworcel Notifies Congress of Demand for Rip and Replace Program," accessed July 18, 2022, https://www.fcc.gov/document/rosenworcel-notifies-congress-demand-rip-and-replace-program.

The third contradiction is the push-and-pull between strategic deployment and domestic politics. Although conducting S&T competition against China, improving S&T innovation capabilities, and investing in critical supply chains have long become bipartisan consensus in the U.S., the domestic controversy regarding the necessity and priority of specific matters will result in dispersed investments, poor results, and delayed processes, among others. The Democratic–Republican conflict regarding corporate tax increase and carbon emissions reduction serves as a prime example in this respect, impeding massive U.S. investments in S&T. In June 2022, Senate Minority Leader Mitch McConnell threatened that if Democrats continued to chase a climate, tax, and prescription drugs deal, he would deprive the U.S. Innovation and Competition Act of necessary Republican support.[1] In addition, influenced by its long-standing culture and systems, there has been widespread controversy within the U.S. as regards federal intervention in S&T markets. Centrists and conservatives believe that markets can allocate resources in the most efficient way, whereas leftists oppose the government's granting benefits to big companies via industrial policies. U.S. former Secretary of Labor Robert Reich once criticized the CHIPS Act as "pure extortion."[2] The Biden administration aims to accelerate the development of advanced manufacturing and encourage the return of critical supply chains using industrial policies. However, the domestic political dynamics inside the U.S. has always hampered his efforts.

The fourth contradiction is the clash between strategic intentions and the S&T innovation ecosystem. What makes the China–U.S. S&T competition special is that it is taking place in a complete ecosystem for S&T innovation. In this ongoing competition, the U.S. not only competes with China but also with S&T. The S&T innovation ecosystem will not directly shape the trajectory of the China–U.S. S&T competition but will react to the competitive actions by both countries and exert pressure in the following two ways. On the one hand, China and the U.S. are mutually interdependent on each other in the S&T inno-

[1] "Sen. Mitch McConnell Threatens to Block $52B in Funding for Semiconductor Industry," accessed July 18, 2022, https://www.cnbc.com/video/2022/06/30/sen-mitch-mcconnell-threatens-to-block-52b-in-funding-for-semiconductor-industry.html.

[2] Robert Reich, "How to End Corporate Welfare," accessed July 18, 2022, https://www.eurasiareview.com/22062022-robert-reich-how-to-end-corporate-welfare-oped.

vation circulation. China is the largest consumer market for U.S. technologies; the technology profits made in China lay an important economic foundation for new S&T innovation back in the U.S. On the other hand, S&T innovation has reached a level where bottlenecks appear with existing foundational theories and industrial capacities, indicating that the S&T strength of the U.S. has approached the limit of phased growth.[1] Currently, worldwide innovation primarily focuses on digital information technology. However, substantive progress is still lacking on energy and materials technology. The history of the Industrial Revolution shows that the countries that take the lead in synergizing information technology, materials technology, and energy technology in the industrial and supply chains will become the forerunner in a new round of S&T revolution and industrial reform.[2]

The fifth contradiction is the divergences between American priorities and the interests of American allies and partners. The fact that U.S. allies and partners also have their own strategic interests and priorities renders achieving the "collective competitive advantages," as the Biden administration has expected, not necessarily certain. For instance, the EU shares the same concern over China's S&T transcendence, but the EU–U.S. competition still exists surrounding the upper ends of industrial and supply chains.[3] On February 8, 2022, the European Commission proposed the European Chips Act that would unlock more than €43 billion of public and private investments to boost its share in the global semiconductor market from the current 10% to 20% by 2030. The U.S. has tried to convince the Dutch lithography giant ASML to stop selling its older deep ultraviolet lithography systems to China to completely cut off the technology supplies from outside China, which have powered the country's chips manufacturing capabilities. In contrast, neither the Dutch government nor ASML has agreed to impose additional restrictions on Chinese chips manufacturers.

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[1] Lei Shaohua, "Beyond Geopolitics: Industrial Policy and Great Power Competition," *World Economics and Politics*, No. 5 (2019): 131–154.

[2] Yang Hutao, "Study on Growth Efficiency of Digital Economy and High-Quality Development of China's Economy," *Studies on Socialism with Chinese Characteristics*, No. 3 (2020): 21–32.

[3] Sun Chenghao and Dong Yifan, "New Developments of U.S.–Europe Relations: Strategic Competitions and Prospects within the Framework of Alliance," *Contemporary American Review*, No. 2 (2020): 101–121.

Similarly, it is unlikely for South Korea to cooperate with the U.S. in building China-less supply chains given the fact that China is the biggest market for South Korean semiconductors. In fact, South Korean semiconductor companies remain optimistic about China's technology markets and supply chains. American allies and partners will presumably favor a case-by-case approach in the future while handling their S&T relations with China, which will make their responses more precise.

The five contradictions discussed above are challenges awaiting the Biden administration in practice, resulting in a gap between the objectives set in its policy documents and relevant policy practice. However, the existence of these five contradictions does not imply that Biden's S&T competition strategy toward China will be a mere formality. Objectively, the Biden administration will not be able to achieve its ideal objectives due to the restraint of strategic costs and resources. Nonetheless, the S&T competition strategy of this administration will certainly impact China's rise in the S&T greatly and further influence the global ecosystem.

First, the Biden administration's S&T competition strategy toward China cannot contain the rise of China in S&T but will restrict the international expansion of key S&T firms from China in a targeted manner. In May 2020, the DOC issued a new foreign direct product rule (FDPR) to target Huawei's acquisition of semiconductors designed or produced abroad with U.S. technology and software, banning contract semiconductor manufacturers outside the U.S. from supplying chips to the Chinese company. This move aims to cut off the technology supply chain for Huawei to upgrade and access self-developed chips. In August 2020, the DOC once again amended its FDPR, requiring a license for the export to Huawei of any "part," "component," or "equipment" using U.S. software or technology to completely restrict Huawei's access to foreign chips developed or produced using U.S. software and technology. According to statistics from Counterpoint, a research firm on the S&T industries, in the second quarter of 2020, Huawei accounted for 20% of the global smartphone shipments, which dropped to 8% in the fourth quarter of the same year and 4% in the first quarter of 2021.[1] This drop indicates that Chinese firms in key and emerging technology

[1] "Global Smartphone Market Share: By Quarter," accessed July 18, 2022, https://www.counterpointresearch.com/global-smartphone-share/.

sectors have become the primary target of U.S. crackdown. These firms will suffer considerable impacts on their international transactions and global market shares.

Second, the Biden administration's S&T competition strategy toward China lacks the necessary policy resources to boost American S&T strength or industrial competitiveness but has ample resources to restrict other countries' access to the technology and knowledge needed to develop S&T industries. Conceivably, China's vulnerabilities in high-technology supply chains will increase. Policy resources required to enhance a country's own S&T strength entail public and private capital incentives; whereas, those required to restrict other countries are the exclusive technology strengths and the institutional advantages the U.S. enjoys at the international level. Currently, the U.S. lacks the ability to provide or attract enough capital. Compared to the funds from potential market returns when industries are normally developing, those provided by the U.S. government through financial subsidies have long been in a state of relative inadequacy. Hence, the U.S. will have difficulties moving faster in the positive competition against China in terms of R&D, industrial base, and supply chains. However, the relative decline of S&T competitiveness does not imply a diluted U.S. dominance over high-technology industries. Conversely, the U.S. control over core technologies through its export regime, investment transactions through its financial regime, and consumer markets through its trade regime[1] renders that it still has sufficient resources to cause trouble for China in critical segments of high-technology supply chains. For instance, the U.S. may cut off the channels for China to obtain advanced technologies, materials, and services from the outside world as a means of sustaining China's reliance on U.S. technologies. Before China achieves substantive breakthroughs in independent R&D, this kind of control, which is exercised primarily in non-market approaches, will exert significant strategic pressure on China.

Third, the Biden administration's S&T competition strategy toward China can be construed as the product of a total securitization of S&T relations with China inside the U.S. In the foreseeable future, a bipartisan consensus on the need to scientifically and technologically supress China will further strengthen,

[1] Li Wei and Li Yuyi, "Decoding the U.S. Hegemony in the Semiconductor Industry: Conceptualizing the Political Economy of Industrial Power," *Foreign Affairs Review*, No. 1 (2022): 22–58.

pushing the Biden administration to introduce tougher S&T policies against China. Such policies will presumably place greater emphasis on national security and less on efficiency and profit correspondingly; in other words, the so-called economic rationality will relatively lose salience. With the rolling out of the China–U.S. strategic competition on all fronts, a special need, i.e., the search for something that is of full importance in terms of security, may arise within the U.S., which will be condensed into a symbol of the strategic competition against China to mobilize domestic politics and maintain a relatively high level of China-related strategic anxiety. Meanwhile, this must be subject to certain requirements; for instance, its nature should make it an "absolute priority" in any discussions. This will enable it to easily attain the powers and opportunities that far exceed normal political conditions and, thereby, lead relevant strategies, policies, and public opinions, consolidating and perfecting the strategic resources of the U.S. Therefore, S&T competition has self-evidently become the top choice for the Biden administration, which is striving to consolidate U.S. political resources at both national and international levels and advance policy agendas, including those governing S&T. Predictably, as America's China policy becomes increasingly extreme, driven by its domestic politics and used as a tool,[1] the Biden administration will be tougher on S&T issues concerning China, since it needs support from Republicans for its legislations and policies.

Fourth, the Biden administration's decoupling from China in critical and emerging technology fields may obstruct the globalization of S&T and lead to a global fragmentation of advanced technologies in the years to come. In the context of a new round of S&T revolution and industrial transformations, this administration is utilizing a strategy of blocs, which not only aims at expelling Chinese firms from the existing S&T supply chains to reduce reliance on China but also looks toward the future by combining U.S. technology standards and values into emerging technologies, in collaboration with U.S. allies and partners, to control the commanding heights of S&T. More importantly, the Biden administration uses technology standards and values as an excuse to remove China from the center circle of the global S&T systems. The Biden adminis-

[1] Wu Xinbo, "How the Changing U.S. Domestic Political Ecology Is Reshaping Its China Policy," *The Chinese Journal of American Studies*, No. 4 (2022): 30–46.

tration, reuniting American allies, called for an Alliance for the Future of the Internet during the Summit for Democracy, which ended up as the DFI unveiled in April 2022. In the DFI, the Biden administration claimed that to "promote trust in the global digital ecosystem," the U.S. and its allies and partners should "promote and use trustworthy network infrastructure and services suppliers, relying on risk-based assessments that include technical and non-technical factors for network security."[1] Such an approach that ties technology with value standards intends to isolate China's achievements in S&T innovation and hamper its R&D cooperation, as well as innovation circulation, with the outside world, which will be detrimental to the improvement, coordination, and innovation of S&T achievements at the global level.

Conclusions

The S&T competition between China and the U.S. is not merely limited to the S&T field but has been shaped by the U.S. into a strategic competition for global leadership. Currently, the S&T competition against China has become a tool for the Biden administration to mobilize political resources and win support for its policies through provoking the "awareness of threats and competition" inside the U.S. It is not that the Biden administration does not see the benefits the S&T cooperation with China is able to provide; psychologically, this administration cannot accept the reality that China is scientifically and technologically rising. In other words, it lacks the political wisdom required to rectify the cognitive framework vis-a-vis China that has proved obsolete, let alone the political courage and ability to thoroughly solve problems. The suppression from the U.S. will increase difficulties for China to upgrade its industries and exacerbate the risk of disruptions to its supply chains. Nevertheless, it will necessitate, to a certain extent, China's resolve to—and expedite China's progression in this respect—build independent and controllable industrial and supply chains.

Currently, the China–U.S. strategic competition has entered a new normal. S&T competition is inevitable. Shaping the concept of "S&T competition" to make it more controllable—through joint efforts—holds the key to preventing

[1] "A Declaration for the Future of the Internet."

the China–U.S. S&T relations from sliding out of control. S&T competition per se can be both cooperative and competitive; it can take place on a forward-moving track that focuses on S&T innovation capabilities or a backward-dragging track that uses system rules as means of coercion. By replacing "complete decoupling" with "small yard, high fence," the Biden administration has exhibited much deeper understanding than the former administration regarding the planning and execution of U.S. S&T competition strategy toward China. Greater attention has been devoted to enhancing the S&T strength of the U.S., and the possibility does exist for a limited modification of U.S. mindset concerning its S&T competition with China. Therefore, China has reason to be cautiously optimistic as regards the future development of its S&T relations with the U.S. In particular, China should improve the resilience of its own system and capabilities to counter the S&T restrictions the U.S. imposes; increase investments in scientific research to secure and elevate the role of Chinese firms in the global division of labor and S&T supply chains; actively perform multilevel, strategic dialogs with groups from the U.S. representing different political tendencies to clarify the boundaries and red lines for the China–U.S. S&T competition; respond to the S&T challenges brought about by the U.S. with greater patience, leveraging the rectifying role of China–U.S. interdependence in the bilateral S&T competition; and downplay security factors and highlight shared interests by actively engaging the U.S. and its allies and partners in the S&T field. Foreseeably, the U.S. may show restraint and abstain from the technology blockades it currently imposes against China as the balance of S&T strength shifts between the two countries. At that time, the S&T cooperation between China and the U.S. will flourish in multiple areas and at multiple levels, and their S&T relations will become more constructive.