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China's Competitive Model for Strategic Science, Technology, and Innovation Development

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The United States and China are locked in a grand struggle for great power dominance, and the strategic science, technology, and innovation (STI) domain is at the very heart of this contest. China is investing enormous effort and resources to forge a strategic STI development model to rival and eventually surpass the United States for global leadership. This report examines the key features of China's Strong, Authoritarian, Mobilizational and Innovation model. The report was originally commissioned by the China program at the U.S. Institute of Peace.

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Chinese authorities are building a highly capable model for strategic science, technology, and innovation (STI) development that takes full advantage of key national attributes such as authoritarian control, mobilizational capacity, and a huge and increasingly prosperous country with enormous potential and realized power and strength. These features comprise what can be termed as the Strong Authoritarian Mobilization and Innovation (SAMI) model.

There have been two versions of the SAMI model since China began to pursue the development of strategic STI capabilities in the 1950s. The first version, SAMI 1.0, was characterized by selectivity, authoritarianism, mobilization, and a mixture of imitation and innovation, and was the prevailing model for the Chinese strategic STI system to the beginning of the Xi Jinping regime in the early 2010s. Since Xi took charge in 2012, he has been determined to turn China into a formidable techno-security power and one of the chief means of achieving this ambitious goal is through a revamped Strong Authoritarian Mobilization and Original Innovation (SAMI 2.0) model.

SAMI 2.0 has undergone significant evolution during the course of Xi's reign in response to rapidly changing external strategic, economic, technological, and military circumstances since the mid-2010s. SAMI 2.0 in the mid-2020s is based on the premise that (1) the world order is deglobalizing; (2) great power militarized competition and the likelihood of regional war is now a dominant dynamic; and (3) China's access to the STI systems of industrialized Western countries is coming to a permanent end.

Xi aims to turn China into a strong science and technology (S&T) power by 2035, making the country a global leader.

One of the top requirements in becoming a strong S&T power is the possession of a completely self-reliant research, development, and production ecosystem for strategic and core STI capabilities. Advanced manufacturing is a crucial component in this effort, and Chinese authorities have set their sights on becoming a high-end manufacturing champion by the mid-2040s.

Another important dimension in the strengthening of strategic STI capabilities is through closer integration of the civilian and military economic and S&T systems. National strategic integration has become the new approach to guide this convergence, which is a bigger, bolder, and broader undertaking than military-civil fusion and involves integrating the highest and most strategic parts of China's economic, technological, military, and national security systems.

The Xi regime has increased its authoritarian command and control of the S&T system with the establishment of the Central S&T Commission in 2023, which comes under the oversight of the Communist Party. The establishment of the Central Science and

Technology Commission (CSTC) has seen the Chinese STI leadership and management system come almost full circle back to its Cold War origins as a highly centralized party-led apparatus configured to operate in a contested global environment. Another sign of this increased central oversight in strategic STI and industrial matters is the appointment of a sizable contingent of techno-security-affiliated officials to the Politburo and key state agencies.

The "New Whole-of-Nation System" (NWNS) is a key initiative by the Xi regime to improve the mobilization and targeting of resources for strategic STI development. A core feature of NWNS is to bring together state and market resources to establish "national champions" to lead the competitive charge. Innovation consortia figure prominently in the implementation of the NWNS. Two dozen central-level innovation consortia have so far been established focusing on strategic emerging industries and future industries such as industrial software, industrial mother machines, computing power networks, new energy, advanced materials, and carbon dioxide capture and utilization. These consortia are led by central-level state-owned enterprises (SOEs) with universities, research outfits, local SOEs, and private enterprises as core members.

Building the SAMI 2.0 model has led to the establishment of a two-pronged innovation model in which a high-end original innovation component co-exists alongside the existing absorption-based STI apparatus. There is also a concerted effort to better integrate the compartmentalized innovation and industrial systems to address poor levels of commercialization and technology adoption. If successful, this new nexus of original innovation, re-innovation, and industrialization will make China a formidable global challenger to the long-standing innovation leadership of the United States.

The next decade will be a crucial period in determining the long-term outcome of the U.S.-China techno-security race. As China ramps up the building of its SAMI model and pours enormous resources into this effort, the United States also needs to significantly raise its material and political support for its STI system. But Washington has started to significantly cut back federal funding for S&T research and reduce the ability of top research universities to conduct cutting-edge research. If these dynamics persist, then the time that China pulls level with the United States in strategic STI and starts to move ahead may occur sooner rather than later.

While the United States has enjoyed great success with a bottom-up, market-led approach to STI governance, Washington needs to make the management of STI policy matters a much higher priority and integrate its leadership, which is currently fragmented and of low bureaucratic standing. Having a high-level cabinet-rank STI department in charge will allow the United States to more effectively compete against China and stay ahead of the transformational technological changes that are presently taking place.

Introduction

China under the leadership of Xi Jinping is working feverishly to establish itself as a credible challenger to the United States for global supremacy in science, technology, and innovation (STI) in the strategic, defense, and civil-military dual-use realms. Xi sees China under Communist Party rule as possessing unique advantages in the race for STI dominance. In a 2016 speech to the country's top scientists and engineers, Xi pointed out that "Our greatest advantage is that under our socialist system we can concentrate our efforts on doing big things. This is an important magic weapon for us to achieve our goals."[1]

What Xi meant was that China possessed three distinct attributes:

1. **Authoritarian rule:** This refers to the highly disciplined Leninist-style top-down nature of the Chinese political and bureaucratic systems;
2. **Mobilizational capacity:** The Chinese state can effectively mobilize the country's vast resources to carry out precisely targeted objectives; and
3. **Becoming strong and powerful:** China is working hard to turn its huge and increasingly prosperous economy and sophisticated technological base into actual strength and power, especially through grand strategic endeavors that showcase its colossal might.

This paper examines these three characteristics along with the approach to original innovation and high-end industrialization that is at the center of current leadership attention. Taken together, these four features comprise what can be termed as the Strong Authoritarian Mobilization and Innovation (SAMI) model. China has had two versions of this SAMI model since it began to pursue the development of strategic STI capabilities from the second half of the 1950s. This paper will first provide a brief overview of the Maoist historical roots of the SAMI 1.0 model before turning to the SAMI 2.0 model in the Xi era. A detailed understanding of the nature and dynamics of the SAMI 2.0 model will allow for a more rigorous and nuanced assessment of the current and future development of China's strategic STI system and whether it will be able to mount a sustainable challenge against the United States for global strategic STI leadership.

[1] "Xi Jinping: Struggle to Build a Strong Country in Science and Technology," ***Xinhua News Agency (新华社)***, May 31, 2016.

The SAMI Model Between the 1950s to 2010s: Selectivity, Authoritarianism, Mobilization, and Imitation/Innovation

When China first embarked on the crash development of strategic and defense STI capabilities in the mid-1950s, this undertaking became known as "Two Bombs, One Satellite" because the central focus was on the building of nuclear weapons, long-range ballistic missiles, and satellites.[2] The chief attributes of the strategic innovation model during this Maoist period were selectivity, authoritarianism, mobilization, and a mixture of imitation and innovation, which will be referred to as the SAMI 1.0 model:[3]

- **Selectivity:** China in the 1950s was an impoverished war-ravaged country with only a rudimentary science and technology (S&T) base, so the authorities had to be extremely selective in the allocation of meager resources available to invest in strategic STI development. Only a small number of projects deemed to be of the utmost importance to the country's national security received major funding, which primarily went to the development of strategic deterrence capabilities.
- **Authoritarianism:** Political and bureaucratic rule in Maoist China was authoritarian in nature, which meant that it was highly centralized and top-down in the way it operated. The top echelons of the Chinese Communist Party (CCP) directly led and managed the strategic STI system through high-level entities such as the Central Special Commission (CSC) that was established in 1962 to oversee all the projects under the Two Bombs, One Satellite portfolio.4
- **Mobilization:** An instrumental attribute of the authoritarian might of the Maoist party-state was its ability to comprehensively mobilize the material, human, and institutional assets and capabilities of the national system for whatever tasks it wanted to be carried out. This wide-ranging mobilization capacity helped to offset the lack of resources and weak capabilities of the S&T base. This mobilization capacity though had to contend with deeply fragmented and decentralized bureaucratic and economic systems, but mobilization drives were easy to justify and undertake when China was on a war footing and faced acute external security threats during the Maoist period.
- **Imitation/Innovation:** The general Chinese S&T system during the Maoist period was overwhelmingly engaged in imitative practices that included

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[2] Tai Ming Cheung, ***Fortifying China*** (Ithaca, N.Y.: Cornell University Press, 2013).

[3] For a detailed analysis of the history and development of the SAMI model, see Tai Ming Cheung, ***Innovate to Dominate: The Rise of the Chinese Techno-Security State*** (Cornell University Press, 2022), Chapter 5.

[4] See Lu Feng and He Pengyu, "National System and Major Breakthroughs – Historical Experiences and Enlightenment of Implementing and Completing Major Tasks with Special Institutions," ***Management World (管理世界),*** No. 7, 2021.

activities such as reverse engineering of foreign platforms. By contrast, the strategic STI sector primarily pursued original innovation because it could not get access to foreign technology or know-how. This original innovation occurred largely within the research and development realm and does not appear to have extended into the production process as the output of Chinese strategic weapons and equipment during the Maoist period was low.

SAMI 1.0 was the prevailing model for the Chinese strategic STI system from the 1950s to the beginning of the Xi regime in the early 2010s. But while the SAMI model enjoyed privileged status during the Maoist era between the 1950s to the late 1970s, its place in national priorities declined sharply as the country pivoted from militarization to economic development and opening up to the outside world under Deng Xiaoping. Funding for strategic STI programs was drastically cut back, and even when high-level initiatives such as the 863 program was established, they had shoestring budgets.

The defense component of the SAMI 1.0 model though did enjoy a major revival at the beginning of the 21st century with the establishment of the 995 New High Technology Program, which was Beijing's strategic response to the bombing of the Chinese Embassy in Belgrade, Yugoslavia, by the United States.[5] Chinese decision-makers determined that the attack posed a grave danger to the country's national security and the 995 program was directly overseen by the highest echelons of the party-state leadership and urgently carried out by the People's Liberation Army (PLA) and strategic weapons complex to develop anti-access, area-denial deterrence capabilities to counter the United States. Numerous high-technology weapons programs were started that ranged from anti-ship ballistic missiles and hypersonic systems to anti-satellite weapons and stealthy fighter aircraft.

What this meant for the SAMI model was that selectivity was no longer a core characteristic and was replaced by the concept of becoming strong. This notion of strengthening is deeply embedded in Chinese strategic culture stretching back into imperial times. "Rich Nation, Strong Army" is a well-known phrase that ties properous states with the requirement to develop powerful military might. Being strong is also about doing bigger, better, and bolder things.

Another impact on the SAMI model was a gradual shift from the immitation-dominant approach toward a more balanced imitation-creative innovation equilibrium. In an increasingly hostile threat environment, there is a pressing need to develop novel indigneously sourced capabilities to offset the technological superiority of the United States and its allies. What begins to emerge is a revamped SAMI model.

[5] See Cheung, *Innovate to Dominate*, pp. 181–184.

SAMI 2.0 Under Xi Jinping: The Strong Authoritarian Mobilization and Original Innovation Model

When Xi took office in 2012, he elevated the importance of national security and STI to the top of national priorities alongside economic development. Xi is determined to turn China into a formidable techno-security power and one of the chief means of achieving this ambitious goal is through a significantly upgraded Strong Authoritarian Mobilization and Original Innovation (SAMI 2.0) model.

The SAMI 2.0 model has undergone significant evolution during the course of Xi's reign in response to rapidly changing external strategic, economic, technological, and military circumstances, especially since the mid-2010s. In the opening years of Xi's rule when his administration formulated the nature and workings of the SAMI 2.0 model, the overall relationship between China and the West was generally close and friendly, although there were emerging signs of stress and acrimony. Economic, diplomatic, and S&T engagement was deep and wide-ranging and strategic and military ties were also occurring frequently if more warily.

The building of the SAMI 2.0 model in Xi's first term was based on the premise that China would remain an integral member of a globalized and peaceful world order. This meant continuing economic interdependence, building trust and cooperation in military and national security matters, and maintaining access to the advanced technology and knowledge ecosystems of advanced countries. But these expectations began to dramatically unravel in the second half of the 2010s when the first Trump administration declared in its 2017 national security strategy that the United States was locked in a titanic adversarial great power competition with China.[6] Along with a host of other threats, disruptions, and challenges such as intensifying tensions in the Taiwan Strait and a far-reaching global technological and industrial revolution, the Chinese authorities came to a determination in 2017 that the country was encountering "great changes unseen in a century."[7]

The initial formulation was that these "great changes" posed both opportunities and challenges, but as the external environment grew more uncertain for China, the focus turned primarily to threats and challenges. From 2022 onward, Chinese leaders began to also warn of the need to be "more mindful of potential dangers, be prepared to deal with worst-case scenarios, and be ready to withstand high winds, choppy waters, and

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6 White House, ***National Security Strategy of the United States***, 2017 (Washington, D.C., December 2017).

7 Taylor Fravel, "Testimony before the U.S.-China Economic and Security Review Commission, Hearing on US-China Relations at the Chinese Communist Party's Centennial," January 28, 2021, https://www.uscc.gov/sites/default/files/2021-01/M_Taylor_Fravel_Testimony.pdf

even dangerous storms."[8] "Extreme thinking" (极限思维) was an even more ominous phrase that Xi used in 2023 in reference to China's acute threat environment. The first and most significant time that Xi mentioned extreme thinking was at a meeting of the Central National Security Commission in May 2023 when he said that the national security establishment "must adhere" to extreme thinking, although he did not elaborate on what the term meant. Xi subsequently used the phrase and a related term, "extreme scenarios," several more times in high-level forums in the summer and fall of 2023, but the term has not been used since.[9]

The building of the SAMI 2.0 model in the mid-2020s is now based on the premise that (1) the world order is deglobalizing; (2) great power militarized competition and the likelihood of regional war is now a dominant dynamic; and (3) China's access to the STI systems of industrialized Western countries is coming rapidly to a permanent end. So what does the SAMI model look like?

Becoming Strong and Powerful: Advanced Manufacturing and National Strategic Integration

Transforming China from being big to strong has been a constant theme in Xi's strategic vision for the country's long-term quest to become a global leader in strategic STI. In the country's Innovation-Driven Development Strategy (IDDS), a target date of 2035 has been set to achieve this goal of China becoming a strong STI power. In a speech at the National S&T Conference in 2024, Xi pointed out a strong country in science and technology had to have five attributes.[10] First, there must be a strong research and development base that is able to "continuously produce major original and disruptive science and technology achievements." Second, the country must have "strong key core technological research capabilities to support high-quality development and high-level national security." Third, the country must be a strong leader in the global STI order with significant clout and influence. Fourth, the country must have a strong and growing pool and pipline of high-end S&T talent both domestically and internationally. Fifth, the country's national innovation system needs to have a strong and capable governance system.

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8 See Xi Jinping, "Hold High the Great Banner of Socialism with Chinese Characteristics and Strive in Unity to Build a Modern Socialist Country in All Respects," ***Report to the 20th Chinese Communist Party National Congress***, October 16, 2022.

9 These venues were a meeting of the Central Committee for Comprehensively Deepening Reforms on July 11, 2023, and a meeting of the Politburo on September 27, 2023.

10 "Xi Jinping: Courageously Advance Towards the Grand Goal of Building a Strong Country in Science and Technology" (习近平: 朝着建成科技强国的宏伟目标奋勇前进), ***Qiushi (求是),*** No. 7, March 31, 2025, http://www.qstheory.cn/20250330/f377de1042cc451bb9840b495d33c731/c.html

The most strategically vital and pressing of these features is the possession of a completely self-reliant research, development, and production ecosystem for strategic and core STI capabilities. The Xi regime is acutely aware of the country's strategic vulnerabilities due to excessive dependency across a broad array of critical technologies and industrial capabilities. The *Science and Technology Daily*, which is closely affiliated with the Ministry of Science and Technology (MOST), published a series of articles in 2018 highlighting 35 so-called "chokepoint" technologies and products controlled by other countries.[11] Among the most important were semiconductors, photolithography machines, heavy duty gas turbines, aviation design software, high-strength stainless steel, and computer operating systems. Overcoming many of these dependencies is a complex long-term undertaking. A 2023 review by Chinese media organizations of the 2018 list found that this "chokepoint" vulnerability had shrunk to 14 areas.[12]

A considerable number of these chokepoint technologies are in the advanced manufacturing domain, which is an essential component in China's efforts to become strong. The Xi regime set its sights on China becoming a high-end manufacturing champion by the mid-2040s and is pursuing an extensive array of well-funded state-led strategies, plans, and initiatives under the label of becoming a manufacturing strong power. Strategic, dual-use civil-military, and defense industrial development priorities have ranked prominently in this advanced manufacturing initiative from the outset but have gained even more importance with heightened attention being paid to improving manufacturing self-reliance and lessening dependence on foreign sources.

Chinese authorities announced in 2015 that the launch of the "Made in China 2025" (MIC25) initiative would transform the country's manufacturing capabilities from being big (large scale, low quality, and imitative) to also being strong (high quality and innovative) and resilient (secure and self-reliant).[13] The central goal of this ambitious industrial development strategy was a three-stage effort to upgrade China's manufacturing capabilities from the third tier of the global manufacturing value chain to the first tier by the mid-2040s.

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11 For an analysis of this list of chokepoint technologies, see Ben Murphy, ***Chokepoints: China's Self-Identified Strategic Technology Import Dependencies, Center for Security and Emerging Technologies,*** May 2022, https://cset.georgetown.edu/wp-content/uploads/CSET-Chokepoints.pdf

12 "Five Years Have Passed, Do You Know How Many of the 35 'Stuck Neck' Technologies We Have Broken?" (五年过去了,你知道 35 项"卡脖子"技术我们攻破了多少项吗?), ***Xinhua News Agency***, June 9, 2023, https://www.xhby.net/sy/kj/202306/t20230609_7969289.shtml.

13 People's Republic of China State Council, Made in China 2025: Realizing the Manufacturing Power Strategy, May 8, 2015.

Progress so far in reducing foreign dependence in Chinese advanced manufacturing has been mixed. A 2019 comparative study of the global manufacturing landscape by the Chinese Academy of Engineering (CAE) found that China lagged the world's leaders in 15 of 26 industrial sectors:[14]

- "**Large" (差距大) gap in 10 sectors**: Civilian aircraft, aviation airborne equipment and systems, high-end computer numeric control (CNC) machine tools and basic manufacturing equipment, robots, high-technology ships and marine engineering equipment, energy-saving vehicles, high-performance medical devices, new materials, biomedicine, and food equipment.
- **"Significant" (差距巨大) gap in 5 sectors:** Integrated circuits, operating systems and industrial software, core information equipment for intelligent manufacturing, aircraft engines, and agricultural equipment.

An updated assessment in 2023 identified major progress being made in a number of these sectors:[15]

- Many of the large-gap sectors are projected to "enter the world's advanced ranks" by 2030 including civilian aircraft, high-end CNC machine tools and basic manufacturing equipment, robots, engineering machinery, and biomedicine.
- The five significant-gap sectors will still be lagging with the world's leaders by 2030 along with high-performance medical devices, food equipment, and instrumentation.

Another important dimension in this strengthening of strategic STI capabilities is through closer integration of the civilian and military economic and S&T systems. While this has traditionally been undertaken through the military-civil-fusion development strategy that was drawn up in the mid-2010s, Xi put forward a new grander military-civil approach in 2023 called Integrated National Strategic Systems and Capabilities (一体化国家战略体系和能力), which for brevity will be referred to as national strategic integration (NSI).[16] NSI appears to be a bigger, bolder, and broader undertaking than MCF and involves integrating the highest and most strategic parts of China's economic, technological, military, and national security systems.

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[14] "Qu Xianming: Strengthening the Manufacturing Base, Leading with Intelligence, and Surging New Momentum for the Manufacturing Industry" (屈贤明:制造强基 智能引领 澎湃制造产业新动能), ***Xinhua News Agency (新华网),*** November 28, 2023, http://www.news.cn/tech/20231128/e62ebcfe6b2e446d9c95b15a79c656df/c.html

[15] "We Now Have Four Major Shortcomings, Which May Lead to the Suffocation of an Industry," ***Guancha.com (观察者网),*** March 17, 2021, https://www.sohu.com/a/456007873_115479

[16] See Tai Ming Cheung, ***National Strategic Integration: How China is Building Its Strategic Power***, University of California Institute on Global Conflict and Cooperation policy brief, October 2023, https://ucigcc.org/publication/national-strategic-integration-how-china-is-building-its-strategic-power/

NSI is a top-level system-of-systems construct intended to coordinate and pool together strategic capabilities and resources from across civil and military, central and provincial, and state and private sector jurisdictions to create a more capable and integrated system able to perform better than the sum of its constituent parts in the execution of strategic and national security tasks. Xi has referred to the construction and improvement of NSI as a complex systems engineering undertaking.

Very little public information is available on NSI activities, how it is set up, and how it operates. However, the tight veil of secrecy surrounding NSI was pulled back slightly when Xi talked about the NSI concept publicly for the first time to military delegates at the National People's Congress in 2023. Xi identified several key priorities for NSI, some of which were especially relevant to militarization:[17]

- Strengthen the defense industrial base to enhance resilience of its industrial infrastructure and supply chains and improve its structural layout
- Increase the country's strategic reserve capacity and intensify efforts to build and integrate strategic infrastructure and resources
- Improve coordination of national development and security, especially between economic and national defense construction
- Support the PLA in its pursuit of its 2027 centenary goals and build the armed forces into a world-class leader over the longer term

[17] "Unify Thinking and Understanding, Strengthen Mission Responsibility, Pay Close Attention to Work Implementation, and Strive to Create a New Situation of Integrated National Strategic System and Capacity Building," ***People's Daily,*** March 9, 2023.

Authoritarian Leadership: The Establishment of the Central Science Technology Commission

An iron-clad principle of Xi's authoritarian rule is the insistence on "strengthening the centralized and unified leadership" of the CCP across all areas of state, society, and security.[18] This has seen the establishment of high-level central party commissions to oversee key policy arenas such as foreign affairs, national security, cyberspace, financial and economic affairs, and political and legal affairs. In the strategic STI domain, a triumvirate of party and joint party-military commissions are in charge: the Central Military Commission 995 Leading Small Group (995 Group) that is responsible for defense S&T matters, the Central Military-Civil Fusion Development Commission (CMCFDC) that oversees dual-use affairs, and the CSTC that deals predominately with civilian-centric strategic S&T issues.

The CSTC is the newest of these three organizations, having been set up in 2023. The establishment of the CSTC has seen the Chinese STI leadership and management system come almost full circle back to its Cold War origins as a highly centralized party-led apparatus configured to operate in a contested global environment. But the CSTC is much more than just a 21st century version of the CSC, because it presides over a STI system that is far larger and more advanced, globally intertwined, and commercially driven than its Maoist predecessor.

The CSTC's creation was part of a "Party and State Institutional Reform Plan" issued jointly by the Central Committee of the CCP and State Council. The plan provided a short description of the responsibilities of the CSTC that can be divided into mission, invention, and system-oriented tasks.[19] The first invention-oriented task is to "study and deliberate on major national S&T development strategies, plans, and policies." The role of the CSTC here is to oversee the drafting of top-level S&T development macro-level guidance, strategies, and plans, especially coordinating input and managing consensus among competing agencies, which will then be approved by the Politburo Standing Committee and rubber-stamped by the CCP Central Committee. Detailed formulation would be undertaken by MOST as the permanent secretariat.

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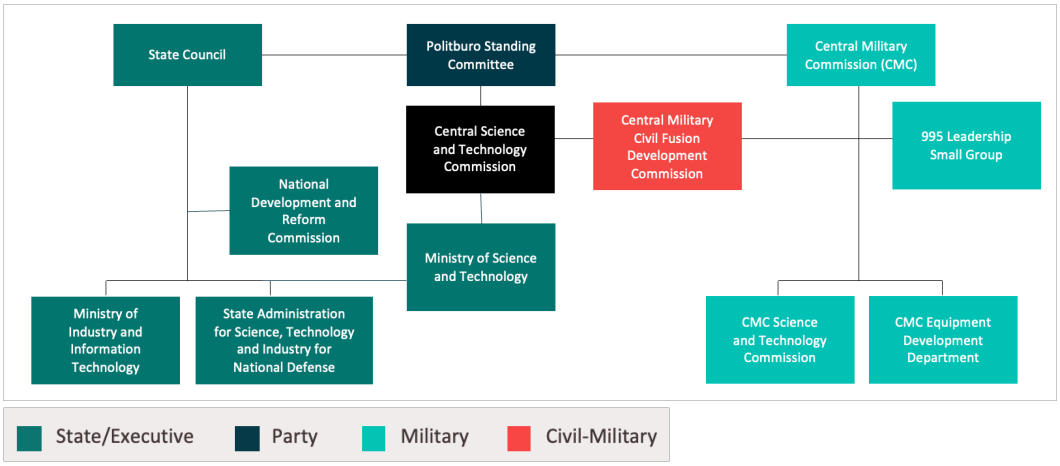
[18] "Chinese Communist Party Central Committee and State Council Issues the Party and State Institutional Reform Plan" (中共中央 国务院印发'党和国家机构改革方案'), ***Xinhua News Agency (新华社),*** March 16, 2023, https://www.gov.cn/gongbao/content/2023/content_5748649.htm

[19] This sorting of innovation tasks into these three categories comes from Jakob Edler and Jan Fagerberg, "Innovation Policy: What, Why, and How," ***Oxford Review of Economic Policy,*** Vol. 33, No. 1, 2017.

The second system-oriented task is to "strengthen the party's centralized and unified leadership over S&T work." China's national innovation system is sprawling and compartmentalized with scores of competing ministries and agencies, making coordination and control a major challenge. This centralized leadership is also a key part of the SAMI model. The third mission-oriented task is to "determine national strategic S&T tasks and major scientific research projects." This is likely the foremost priority of the CSTC, but a key question is whether the focus is on drawing up new tasks and projects or executing an already well-defined list of 1–2 dozen megaprojects.

The fourth system-oriented task is to "coordinate the deployment of strategic S&T forces (战略科技力量), such as national laboratories, and coordinate military-civil S&T fusion development," This description distinguishes between S&T integration at the strategic level and S&T fusion at the civil-military level. Since 2017, Chinese authorities have put forward the idea of an "integrated national strategic system" (一体化国家战略体系), which is how economic development and national security can be coordinated and brought together into a seamless dual-use ecosystem.[20] This process of NSI is aimed at advanced and core technologies that are of actual or potential strategic commercial or military importance for the country. Semiconductors, AI, and quantum information are some of the most obvious technologies that fit into this category. CSTC is likely to oversee NSI, especially for civilian-related activities, while military-oriented matters will be handled by the CMCFDC, 995 Group, and the CMC Science and Technology Commission.



[20] See, for example, Lian Zhenyu, Gu Tongfei, Xue Qi, and You Guangrong, "Research of the Integrated National Strategic System and Capabilities: Concept, Framework and Construction," ***Studies in the Science of Science (科学学研究),*** Vol. 41 No. 4, April 2023.

The Place of the Central Science and Technology Commission in China's Top-Level Science, Technology, and Leadership System

The CSTC replaced four state leadership small groups (LSGs) dealing with S&T affairs. The most important and longest running of these LSGs was the State Council National Science and Technology LSG, which was chaired by the premier and had a broad mandate to oversee all S&T-related activities. The other three LSGs were established in the late 2010s and tasked with specific missions.

The CSTC met in plenary session for the first time a few months after its establishment, although there was no official announcement or media reporting of this event. A report by the Beijing Municipal Science and Technology Committee in January 2024 indicated that the CSTC had held three plenary sessions by the beginning of 2024, which meant that it met on average every three months.[21]

The actual power and influence of the CSTC is derived most crucially from its leadership arrangements, especially in three areas: (1) its leader will be the most important factor in determining the commission's overall political and decision-making clout; (2) the composition of the rank and file membership of the leadership will be crucial in ensuring the reach of the commission into the official bureaucracy; and (3) the director of the general office will be in charge of the permanent secretariat and run the day-to-day operations of the commission that will be pivotal for policy implementation.

Ding Xuexiang was revealed as the CSTC director in June 2024.[22] Ding is part of Xi's inner circle of trusted advisers having spent ten years as Xi's chief of staff before being promoted to the Politburo Standing Committee in 2022. Ding was trained as a materials scientist and spent the first two decades of his career working at the Shanghai Materials Research Institute before becoming an official in the Shanghai Municipal Science and Technology Commission. Ding was given responsibility of the S&T portfolio in the State Council when he was made executive vice-premier in 2023.[23]

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21 "Summary of the Performance Management Work of Beijing Municipal Science and Technology Commission and Zhongguancun Science Park Management Committee in 2023," ***Beijing Municipal Science and Technology Committee General Office***, January 12, 2024, https://kw.beijing.gov.cn/art/2024/1/12/art_8990_672630.html

22 "Ding Xuexiang, Director of the Central Science and Technology Commission: We Must Promote S&T Innovation With a New National System," ***Science and Technology Innovation Board Daily (科创板日报)***, June 26, 2024, https://m.cls.cn/detail/1715692

23 "Ding Xuexiang Sets Fast Pace for China's Hi-Tech Drive in Another Sign of New Role," ***South China Morning Post***, May 27, 2023, https://www.scmp.com/news/china/politics/article/3221950/ding-xuexiang-sets-fast-pace-chinas-hi-tech-drive-another-sign-new-role

While Ding is the official head of the CSTC, Xi remains closely involved in overseeing STI matters, and the question is what will be the nature of his engagement and participation in the CSTC's decision-making process. As Xi is party general secretary and CMC chairman, the CSTC will report to him either directly or through the Politburo Standing Committee and CMC, so he will still have final decision-making authority. A MOST department report referencing the CSTC's inaugural meeting in the summer of 2023 made clear that Xi was of central influence in the commission's affairs by noting that the "spirit of the first meeting of the CSTC" along with other key S&T guidance provided by Xi should be carefully studied. [24]

Besides Ding, the rest of the CSTC membership lineup has not been made public. The Ministry of Natural Resources (MNR) though has said that its minister Wang Guanghua is a CSTC member.[25] Wang's membership would suggest that CSTC membership is inclusive and expansive rather than exclusive and select because the MNR is not a top-tier STI organization. Other likely members include the heads of ministries dealing with S&T, economic, financial, industrial, and personnel affairs, academic and professional organizations like the Chinese Academy of Sciences and CAE, the military and defense industrial apparatus, and provinces with a major S&T footprint.

S&T minister Yin Hejun is almost certainly a CSTC member and the director of the CSTC general office because MOST is responsible for carrying out the administrative, strategic planning, and coordination duties of the CSTC. In an interview in July 2024, Yin said that the CSTC has a heavy workload, pointing out that the new "systematic and holistic" S&T leadership and management arrangements has helped to "accelerate the development of core technologies and to accelerate the layout of new tracks and strategic fields such as quantum technology, artificial intelligence, biomedicine, and new energy; a series of reform measures were introduced to focus on strengthening R&D investment, accelerating the training of young talents, and increasing support for start-up companies, and further stimulate the innovation and entrepreneurship of scientific researchers." Yin added that the CSTC has approved several major national S&T projects, although only the Deep Earth and Mineral Resources megaproject has so far been publicly announced.[26]

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[24] "Party Branch of the Department of Social Development Held a Theoretical Center Group Study," ***Ministry of Science and Technology website***, July 17, 2023, https://www.most.gov.cn/zzjg/jgsz/shfzs/sfdtxx/202307/t20230717_187091.html

[25] "Science and Technology Committee of the Ministry of Natural Resources Held Its First Plenary Meeting," China Ocean Mineral Resources R&D Association, March 19, 2024, http://www.comra.org/2024-03/19/content_42728398.htm

[26] "Gathering the Mighty Power of a New Round of Mineral Exploration Breakthroughs," ***China Mining News,*** January 23, 2024, https://www.cgs.gov.cn/ddztt/qgddh/2024ddh/2024ddhhybd/202401/t20240123_752822.html

A top priority of the CSTC is to support regional STI development and a key mechanism for carrying out this task is the establishment of provincial S&T commissions that coordinate closely with the CSTC. More than 10 provincial S&T commissions had been stood up by mid-2024 and their responsibilities are to ensure that S&T issues are at the top of provincial development priorities, which has not usually been the case. To ensure that these provincial S&T commissions have the authority and political clout to meet their goals, many of them have the provincial party secretary and provincial governor serving as co-directors.[27]

The CSTC also has several special groups that are tasked with specific work responsibilities.[28] No information has been disclosed as to the composition and areas of focus of these special groups.

The Role of MOST

For MOST, its tie-up with the CSTC is a double-edged sword. Politically, this move represents a major upgrading of its clout and authority from a mid-tier state ministry to being situated at the epicenter of national decision-making power. This is a far cry from a decade or more ago when there were rumors that MOST would be abolished to pave the way for a more decentralized S&T management system. There is considerable resentment from the scientific community towards MOST because bureaucrats with limited S&T expertise control the purse strings to funding for research and development.

Bureaucratically, this reorganization is a mixed outcome for MOST. On the positive side for the ministry, it has been able to strengthen its role in a number of key functions: (1) the formulation and implementation of strategies and plans to guide China's near to long-term STI development; (2) spearheading the promotion and implementation of the "new whole-of-nation system" (NWNS, 新型举国体制) initiative; (3) optimizing the management of the S&T innovation chain; (4) promoting knowledge transfer, adoption, and commercialization of S&T output; and (5) ensuring the integration of S&T with economic, national security, and social development. MOST was also able to maintain management responsibilities for a sizeable collection of key R&D portfolios including basic and applied basic research, building national laboratories, forging the national technology transfer system, and national major S&T projects. Another win for MOST is

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27 "Provincial Party Committee Science and Technology Committees Have Been Established in Many Places. In Some Provinces, the Provincial Party Committee Secretary and the Provincial Governor Serve as 'Double Directors,'" ***The Paper (澎湃新闻),*** July 8, 2024, https://www.thepaper.cn/newsDetail_forward_27999283

28 "Projects Arranged by the Central Science and Technology Commission Receive Key Support from Science and Technology Guidance Funds," ***University Artificial Intelligence and Big Data Innovation Alliance (高校人工智能与大数据创新联盟),*** February 27, 2024, https://www.163.com/dy/article/IRVBBE3G0532N2UB.html

keeping the oversight of the National Natural Science Foundation of China. The result of this revamping of MOST allows it to adapt "more completely to the mission-driven, national security-imperative nature of current science and technology policy."[29]

On the negative side, MOST has had to give up a considerable number of its responsibilities, both important and peripheral, which translates into a selective decline in bureaucratic clout and funding. The biggest loss is the management of high-technology industrial development zones, national innovation demonstration zones, and other types of science and technology parks, which have been transferred to Ministry of Industry and Information Technology (MIIT).

Can MOST effectively handle its dual role as a state ministry and full-time secretariat to the CSTC? While the reorganization and streamlining of MOST's responsibilities is intended to make its double-duty workload overlapping and complementary, it still represents a herculean challenge. Before these latest reforms, the staffing level that MOST was allocated by the central government was pegged at 364 positions, although its total headcount exceeded 1,000 if personnel belonging to another 23 entities affiliated with the ministry were also included.[30] This represents a sizeable institutional capacity, and MOST in its role as the CSTC secretariat would almost certainly dwarf the general offices of other party commissions by a wide margin.

Much will depend on the demands that will come from the CSTC, which will likely have priority over ministerial responsibilities. The one brand new tasking that MOST has been given is to manage the NWNS initiative, which is likely to be a busy portfolio. Another key task for MOST is to support the CSTC in deciding on national strategic S&T tasks and supervising the implementation of major S&T programs. This has been one of MOST's principal and long-standing work responsibilities, so it should have plenty of experience and capacity to carry out this mission. Overall, MOST appears be well placed in meeting its new set of duties.

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[29] Barry Naughton, Tai Ming Cheung, Siwen Xiao, Yaosheng Xu, and Yujing Yang, ***Reorganization of China's Science and Technology System***, University of California Institute on Global Conflict and Cooperation Working Paper, July 2023, https://ucigcc.org/publication/working-papers/reorganization-of-chinas-science-and-technology-system/

[30] "Regulations on the Functional Configuration, Internal Organization, and Staffing of the Ministry of Science and Technology," ***Ministry of Science and Technology (科学技术部),*** July 30, 2018, https://www.most.gov.cn/zzjg/kjbzn/201907/t20190709_147572.html, and "What Are the Origins of the Newly Formed Central Science and Technology Commission?" ***China Economic Weekly (中国经济周刊| 发布时间),*** April 3, 2023, http://www.bjb.cas.cn/kjcx/kcsd/202304/t20230403_6725986.html

The Rise of the Techno-Security Faction at the Top of the Chinese Political System

An important new dynamic of the authoritarian leadership mechanism emerged at the 20th Party Congress in 2022 with the rise of a sizable contingent of techno-security-affiliated officials to the top of the CCP apparatus and key state agencies. Four were elected to the 24-member Politburo. These four Politburo members are (1) Ma Xingrui, Xinjiang Party Secretary, who spent much of his career working in the space industry and state defense industrial administration; (2) Zhang Guoqing, Guangdong Party Secretary, who was general manager of NORINCO, one of China's two principal ordnance corporations between 2008 and 2013; (3) Yuan Jiajun, Chongqing Party Secretary, who has worked in the space sector for much of his career; and (4) Gen. Zhang Youxia, CMC executive vice-chairman, who was in charge of the PLA's armament management system between 2012 and 2017.

This techno-security faction accounts for nearly 20 percent of the Politburo lineup, which is the highest-ever level of representation in one of the party's most potent political institutions. In addition, a sizable number of long-serving defense industry officials have been placed in powerful political and bureaucratic positions overseeing key economic and regional portfolios.

Within the state apparatus, the reach of the techno-security constituency was most evident in the appointment of Jin Zhuanlong to head the MIIT in 2022.[31] MIIT is responsible for the management and oversight of China's industrial and high-technology economy, including the defense industrial sector. Jin, who has served much of his career in the defense industry, including as the deputy director of SASTIND between 2005 and 2008, was the first member of the techno-security faction to be elevated to this powerful position. Jin, however, was removed from his position at the end of 2024 reportedly because of suspected corruption.

[31] "China Names New MIIT Head After Corruption Probe of Predecessor," ***Caixin Global,*** July 30, 2022, https://www.caixinglobal.com/2022-07-30/china-names-new-miit-head-after-corruption-probe-of-predecessor-101919897.html

Mobilization: The New Whole-of-Nation System and Innovation Consortia

The Xi regime has come up with new and improved ways to mobilize, concentrate, and target resources for strategic STI development, of which the NWNS is a central initiative to assemble state and market resources into winning combinations of so-called "national champions." The use of the NWNS term links its heritage to the "national team" concept that was used extensively during the Maoist planning era, but has been extensively updated and made relevant for 21st century challenges and practices. The original "national team" (举国体制) concept was based on the premise that the party-state would rally and concentrate all needed resources from within the country to achieve a specific purpose. This was the building of the nuclear bomb and strategic ballistic missiles during the Cold War.

Chinese analysts point out that the NWNS mobilizational approach is significantly different from the traditional top-down-led management model in two ways that are especially applicable for tackling core and emerging technologies.[32] First is in the assembly and makeup of project teams and consortia. Analysts argue that contemporary core technologies are by their nature highly complex, cross-disciplinary, and involve cutting-edge capabilities that require putting together large-scale teams drawn from numerous sectors. This is especially true of next generation core technologies like quantum and AI/machine learning. Past development of core technologies in the industrial era were more narrowly confined to single industries such as aeroengines, advanced electronics, and nuclear weapons technology. This meant that projects were usually given to a single research outfit to carry out. Under the NWNS approach, project teams or consortia are drawn competitively from an extensive range of qualified entities across different industries. In the Chang'e 4 project, for example, research bids were accepted from institutions outside of the aerospace industry that had "a positive track record of breaking down barriers into the aerospace industry, accelerating space innovation, reducing engineering costs, and improving investment returns."[33] A second important new feature of the NWNS concept is the inclusion of the market economy as a key source for resources and other inputs into the development process. The goal is to reduce reliance on state funding and increase access to market-based resources.

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[32] Hu Yongshun, "What is the New Whole of Nation System?" (新型举国体制什么样?). ***Liaowang,*** January 7, 2020, http://paper.news.cn/2020-01/06/c_1210426434.htm

[33] Hu Yongshun, "What is the New Whole of Nation System?"

The NWNS framework became an authoritative operational concept at the CCP Central Committee Fourth Plenum in October 2019. The plenum called for the building of a "new whole-of-nation system for key core technologies under a socialist market economy."[34] The COVID pandemic temporarily paused the rollout of the NWNS initiative, which resumed in September 2022 when Xi chaired a meeting of the Central Commission for Comprehensively Deepening Reforms that adopted a resolution on the NWNS, which provided a detailed explanation of the concept. The NWNS is "an organizational model and operating mechanism that is oriented toward the major needs of the country, targets key core technologies and 'bottleneck' areas, leverages the decisive role of the market in resource allocation, better utilizes the role of the government, strengthens the mechanism for implementing responsibilities, utilizes the vast domestic market demand, and integrates national strategic science and technology forces and social resources to jointly tackle major technological challenges."[35] The resolution points out that "what is 'new' in this 'new-style' system is better integration between a proactive government and an efficient market, under conditions of a dialectic unity of a self-reliant technology great power and international scientific and technological cooperation." The resolution said that teams should be established to conduct "R&D on key technologies with first-mover advantages and basic frontier technologies that will lead future development."

Other policy documents and regulations spell out what kinds of organizational constructs the Chinese authorities have in mind to spearhead this state-led, market-supported effort. The 2021 Law of the People's Republic of China on Science and Technology Progress said "the state shall encourage enterprises, S&T research and development institutions, higher education institutions, and other organizations to establish cooperation mechanisms featuring complementary advantages, clear division of labor, and sharing of achievements and risks, jointly form R&D platforms (研究开发平台), technology innovation alliances (技术创新联盟), and innovation consortia (IC, 创新联合体) in accordance with market mechanisms."[36]

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[34] "Fourth Plenum of the 19th Chinese Communist Party Central Committee, "Decision of the Chinese Communist Party Central Committee on Several Major Issues Concerning Upholding and Improving the Socialist System with Chinese Characteristics and Promoting the Modernization of the National Governance System and Governance Ability" (中共中央关于坚持和完善中国特色社会主义制度推进国家治理体系和治理能力现代化若干重大问题的决定), ***Xinhua News Agency,*** November 5, 2019, http://www.xinhuanet.com/2019-11/05/c_1125195786.htm

[35] Central Commission for Comprehensively Deepening Reforms, "Opinions on Improving the New-Style Whole of Nation System for Key Core Technology under the Conditions of the Socialist Market Economy (关于健全社会主义市场经济条件下关键核心技术攻关新型举国体制的意见), September 8, 2022, http://www.china-cer.com.cn/zhengcefagui/2022090821090.html

[36] National People's Congress, ***People's Republic of China Science and Technology Progress Law (中华人民共和国科学技术进步法),*** December 24, 2021, https://www.most.gov.cn/xxgk/xinxifenlei/fdzdgknr/fgzc/flfg/202201/t20220118_179043.html

The central authorities have been particularly keen to promote the development of innovation consortia, which was highlighted in the 2022–2023 Action Plan for Improving the Technological Capabilities of Enterprises jointly issued by MOST and the Ministry of Finance.[37] The action plan called for the establishment of "systematic task-based ICs" between "central enterprises and leading private technology companies" to focus on "major national needs," especially to engage in breakthrough R&D in key and core technologies. The plan also called for the formation of enterprise-led ICs to carry out national S&T projects, which would require enterprises to establish national technology innovation centers and other types of innovation bases.

Two dozen central-level ICs have so far been established under the administrative oversight of the State-owned Assets Supervision and Administration Commission.[38] The focus has been on strategic emerging industries and future industries such as industrial software, industrial mother machines, computing power networks, new energy, advanced materials, and carbon dioxide capture and utilization. These consortia are led by central-level state-owned enterprises (SOEs) with universities, research outfits, local SOEs, and private enterprises as core members.

Three types of ICs have so far been established:[39]

- **High-Energy-Level IC (高能级创新联合体) (HELIC):** These consortia are the elite "national teams" in the IC mobilization effort and are comprised of the country's leading SOEs, universities, and research institutions and are assigned by the state to address the most strategic and pressing S&T missions. The overwhelming majority of the 24 central-level ICs fall into this category. Examples of these ICs are the China Nonferrous Industry–University–Research Technology IC, Central SOE Carbon Fiber IC, Core Electronic Components IC, Central SOE Major Equipment Key Basic Components IC, and the Low Altitude Economy IC.

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[37] Ministry of Science and Technology (科技部) and Ministry of Finance (财政部), ***"Action Plan for Improving the Technological Capabilities of Enterprises, 2022-2023" (企业技术创新能力提升行动方案, 2022–2023 年),*** Chinese Government Website, August 5, 2022, https://www.gov.cn/zhengce/zhengceku/2022-08/15/content_5705464.htm

[38] "Central Enterprises Take the Lead in Establishing Multiple Innovation Consortia" (央企牵头多个创新联合体密集成立), ***Economic Information Daily (经济参考报),*** July 22, 2024, http://www.ce.cn/cysc/yq/dt/202407/22/t20240722_39076963.shtml

[39] See Yuan Ye, Cao Qian, Yin Ximing, Chen Jin (袁 野,曹倩, 尹西明, 陈 劲), "The Theoretical Mechanism and Practical Path of Innovation Consortium Empowering New Quality Productivity" (创新联合体赋能新质生产力的理论机制与实践路径研究), ***Science and Technology Progress and Policy (科技进步与对策)*** Vol. 41, No. 20, 2024, https://www.kjjb.org/article/2024/1001-7348/2024-41-20-004.htm

- **Deep Fusion Industry-University-Research IC (产学研深度融合创新联合体) (DIURIC):** This category of ICs is closely tied to the basic and applied research system and is a conduit for the commercialization of advanced domestic original innovation and re-innovated technology. An example of a DIURIC is the Basic Research Innovation Consortium (基础研究创新联合体) that pursues enterprise-driven fundamental research to support industrial requirements. There is a pressing need for this type of IC in core and emerging technology domains, especially semiconductor manufacturing, operating systems, and high-end chip design. This category of IC can be found at both the central and sub-national levels.
- **General IC (一般创新联合体) (GIC):** These ICs are loosely coupled formations that are primarily driven by economic and commercial priorities rather than national strategic considerations. This category is largely made up of provincial, sub-provincial, and privately organized ICs. There are thousands of ICs, predominately GICs, at the provincial and sub-provincial level where the administrative requirements to establish these entities are far less exacting than at the central level.

The leadership structure of HELICs is fundamentally different from their GIC counterparts. HELICs are organized in a top-down approach in which central state agencies arrange for the formation of consortia and assign a S&T-oriented SOE to take charge, while GICs are created bottom-up by local actors.

Innovation: Original Innovation and New Quality Productive Forces

China's STI system is in the middle of a far-reaching transformation from a predominantly absorption-based innovation development model to a two-pronged innovation model in which a high-end original innovation component co-exists alongside the absorptive apparatus. Moreover, there is a concerted effort to better integrate the compartmentalized innovation and industrial systems to address poor levels of commercialization and technology adoption. If successful, this new nexus of original innovation, re-innovation, and industrialization will make China a formidable global challenger to the long-standing innovation leadership of the United States.

China is pouring enormous resources into original innovation, especially on fundamental research and big science research projects. The Xi regime is especially keen on disruptive and breakthrough STI in promising emerging domains as this would allow China to leapfrog to the front of a crowded and highly competitive field.[40] After many decades of lagging far behind in R&D investment, China has nearly caught up with many of the world's advanced countries. China's R&D intensity in 2023 was 2.6 percent, compared with an average of 2.7 percent among Organization of Economic Cooperation and Development members.[41] A significant, though narrowing, gap remains between China and the research intensity of the most technologically advanced countries such as the United States (3.45 percent) and Japan (3.44 percent.)

The cultivation of a truly world-class original innovation system will take at least another one to two decades to adequately bear fruit. This is because of the extensive array of infrastructure, organizations, and talent that is needed, such as state-of-the-art research universities, large-scale national laboratories, and scientific talent capable of winning Nobel prizes. Achieving leadership in emerging fields where there is first-mover advantage may offer an easier path for China to gain technological dominance, and this is a key rationale why Chinese authorities are investing heavily in many of these domains.

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[40] Bai Chunli, "Strive to Make Breakthroughs in Original Innovation" (着力突破性原始创新). ***Economic Daily***, January 15, 2013, http://views.ce.cn/view/ent/201301/15/t20130115_24027641.shtml

[41] ***"R&D Spending Growth Slows in OECD, Surges in China; Government Support for Energy and Defence R&D Rises Sharply,"*** Organization for Economic Cooperation and Development, March 31, 2025, https://www.oecd.org/en/data/insights/statistical-releases/2025/03/rd-spending-growth-slows-in-oecd-surges-in-china-government-support-for-energy-and-defence-rd-rises-sharply.html

An indicator of China's newfound willingness to make expensive investments in cutting-edge research is a major surge in funding for big science infrastructure projects. Between 1960 and 2010, China invested in 33 big science projects, but this number is estimated to have more than doubled to the mid-70s by the end of the 14th Five-Year Plan (FYP) in 2025. This accelerated push to build these big science projects began toward the end of the Hu Jintao administration with the issuance of the Medium- and Long-Term Plan for the Construction of National Major Science and Technology Infrastructure (2012–2030) in 2012, but has significantly picked up during Xi's tenure. Top research areas of focus include energy science, earth systems and environmental science, material sciences, life sciences, particle physics and nuclear physics, space and astronomical sciences, and engineering technology sciences.

China is now the world's leader in the total number of big science projects, followed by the United States that, according to Chinese estimates, has around 60 big science projects. However, only a small handful of Chinese big science projects are of world-class standard, such as large-scale superconductivity and precision manufacturing, while the vast majority lag well behind their foreign counterparts.

While original innovation is a long-term undertaking, China is looking to ramp up its high-end industrialization model for more immediate and near-term results, especially to boost the country's flagging economic growth. This advanced industrialization strategy is known as "new quality productive forces" (NQPF, 新质生产力) and was first mentioned by Xi in the fall of 2023 and subsequently adopted as the country's new economic development blueprint in 2024. NQPF should be regarded as the next stage in the implementation of Xi's grand strategic development guidance as encapsulated in the IDDS. The official Chinese definition of NQPF is "advanced productivity that is freed from traditional economic growth mode and productivity development paths and are characterized by 'high-tech, high efficiency, and high quality.'" Key examples of NQPF output include electric vehicles, humanoid robots, quantum computers, nano-manufacturing, nuclear fusion, deep sea mining, and genetic engineering. Many of these technologies are strategic in nature.

Demonstrating the SAMI 2.0 Model: The 2025 Beijing Military Parade

China used the 80th anniversary of the defeat of Japan that ended the Second World War in September 2025 to showcase its increasingly cutting-edge technological and industrial ability to indigenously design, develop, and produce world-class state-of-the-art advanced weapons and military equipment across the entire spectrum of warfare needed to deter or fight and win against any adversary, of which the United States is the center of attention.

The parade demonstrated that China's defense innovation and industrial bases are decisively shifting from the SAMI 1.0 catch-up and advanced imitation model to the SAMI 2.0 cutting-edge original innovation approach across all techno-industrial domains that include the nuclear, space and missile, ground/ordnance, aviation, electronic and new domain, and naval shipbuilding sectors.[42] The breadth and depth of new and improved military capabilities on show can be directly attributed to the intensive and sustained high-level attention and hands-on involvement that Xi and his leadership team have paid to the accelerated development of military capabilities during his tenure. This urgency has significantly picked up since the late 2010s as the threat of war, arms races, and long-term militarized competition have significantly increased with the onset of U.S.-China great power competition, sharply rising tensions across the Taiwan Strait and elsewhere along China's periphery, and the outbreak of major wars around the world.

In his keynote speech at the 20th Party Congress in 2022, Xi said that there were two key strategic tasks for the military over the course of his third term in power. The first is to accomplish goals for when the PLA turns 100 in 2027; the second requirement is to "more quickly elevate" the PLA into a world-class force.[43]

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[42] See Joshua Arostegui, ***China's September 2025 Military Parade: How PLA Ground Forces Are Adapting to Future Wars and Force Projection,*** Strategic Studies Institute, US Army War College -September 2025, https://ssi.armywarcollege.edu/SSI-Media/Recent-Publications/Article/4294886/chinas-september-2025-military-parade-how-pla-ground-forces-are-adapting-to-fut/; Xiaoke Qi, ***The PLA's New-Quality Forces: The Information Operations Group at the 2025 Military Parade***, China Aerospace Studies Institute, September 2025, https://www.airuniversity.af.edu/Portals/10/CASI/documents/Research/CASI%20Articles/2025-09-22%202025%20Military%20Parade%20Information%20Operations%20Group.pdf?ver=brvVqMOj7RcC1V-Nc3aTLg%3d%3d; "Lasers, Hypersonic Missiles and the 'Nuclear Triad': China Flexes its Military Muscle", Kathrin Hille, ***Financial Times,*** 3 September 2025; and Hans Kristensen Et Al, "Nuclear Weapons At China's 2025 Victory Day Parade", ***Federation of American Scientists,*** 4 September 2025, https://fas.org/publication/nuclear-weapons-at-chinas-2025-victory-day-parade/

[43] Xi Jinping, ***"Hold High the Great Banner of Socialism with Chinese Characteristics and Strive in Unity to Build a Modern Socialist Country in All Respects,"*** Report to the 20th National Congress of the Communist Party of China, October 16, 2022, https://en.qstheory.cn/2023-01/06/c_845251.htm

Although the Chinese authorities have not clearly specified what the 2027 goals are, Xi provided an extensive list of objectives in his speech for the PLA and the defense industrial base to achieve:

- Enhance strategic capabilities to defend China's sovereignty, security, and development interests.
- Establish a strong strategic deterrence system.
- Increase the ratio of new domain forces.
- Speed the development of unmanned, intelligentized combat capabilities, and promote the coordinated development and application of network information systems.
- Improve the layout of the defense S&T and industrial systems and step up capacity building.
- Improve command systems for joint operations, reconnaissance and early warning capabilities, joint strikes, battlefield support, and integrated logistics support.
- Implement major projects to develop defense S&T, weapons, and equipment and move faster to translate S&T advances for combat operations.

At least in terms of STI capabilities, the military parade showed that the Chinese defense innovation ecosystem has been highly responsive to Xi's requirements by building up a highly productive and capable pipeline of programs that are already or close to being ready for full-rate production. Numerous new and significantly improved weapon systems were displayed, of which the most prominent covered both established and emerging domains:

- **Nuclear deterrent capabilities:** New missiles included the DF-61 intercontinental ballistic missile, the JL-3 ship-launched ballistic missile, and the JL-1 air-launched ballistic missile.
- **Uncrewed and autonomous platforms:** China has made major technological strides in this emerging domain as shown by products such as the GJ-11 uncrewed combat air vehicle that can accompany manned aircraft, AJX-002 large unmanned underwater vehicle, and an array of unmanned ground vehicles and robotic systems.
- **Directed energy and air defense systems:** The LY-1 high-energy laser weapon system displayed at the parade is compact and mobile and that can be vehicle and ship-mounted. The HQ-29 exo-atmospheric air defense system was also shown off that can counter sophisticated aerial threats, including possibly against hypersonic missiles.

- **Hypersonic and cruise missiles:** Since China unveiled the DF-17, its first ballistic missile with a hypersonic glide warhead, at the 2019 National Day military parade, the country's defense indsutrial base has made considerable progress in developing a family of hypersonic anti-ship missiles that was shown at the 2025 parade, including the YJ-21, YJ-15, YJ-17, YJ-19, and YJ-20 missiles. There was also the CJ-1000 long-range hypersonic cruise missile that is based on a scramjet design.

The SAMI Model and the 15th Five-Year Plan

The Chinese authorities began to unveil the broad outlines of the 15th FYP at the 4th Party Plenum in October 2025 that will set the course for the country's economic, social, technological, and national security development for the second half of the 2020s.[44] As the second stage of a 15-year long-term development strategy, the 15th FYP is a continuation of many of the initiatives that started with the 14th FYP, although with some adjustments and new objectives in response to significant changes in the geostrategic, economic, and technological environments in the past few years. The plenum communiqué declared the 15th FYP was an important stepping stone in the goal to reach a per capita GDP "on a par with that of a mid-level developed country" by 2035, emphasizing that by then "China's economic strength, science and technology capabilities, national defense capabilities, composite national strength, and international influence will all be markedly stronger."[45] This emphasis on being strong shows how the 15th FYP encompasses the key traits of the SAMI approach.

Science and Technology Minister Yin Hejun said strategic coordination (i.e., more central authoritarian oversight) would be enhanced in the 15th FYP and the supply of S&T investment and resources will be increased (i.e., stepping up mobilization). The goal is to "accelerate the implementation of major science and technology projects, promote strategically oriented basic research, and strengthen efforts to develop key common technologies, such as semiconductors, and advanced engineering technologies."[46] Yin also stressed the need to improve the coordinated development of national strategic science and technology capabilities, of which dual-use military-civil applications will almost certainly be a top priority, and to facilitate deeper integration between technological and industrial innovation.

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[44] ***Communique of the Fourth Plenary Session of the 20th Central Committee of the Chinese Communist Party***, October 23, 2025, https://www.chinadaily.com.cn/a/202510/24/WS68faba01a310f735438b6991.html

[45] ***Communique of the Fourth Plenary Session of the 20th Central Committee of the Chinese Communist Party,*** October 23, 2025.

[46] ***"The CPC Central Committee Held a Press Conference to Introduce and Interpret the Spirit of the Fourth Plenary Session of the 20th CPC Central Committee,"*** October 24, 2024, http://www.news.cn/zt/ddesjsdscqthy/zgzyfbhzb/index.html

Conclusions and Policy Recommendation

China is making concerted progress in building a comprehensive state-of-the-art strategic STI system with the ultimate goal of credibly challenging the United States for global dominance. Overall, China still has a long way to go to before it catches up with the United States, but this is beginning to occur in select areas such as nuclear fusion, quantum computing and communications, hypersonics, and high-performance computing.

The next decade will be a crucial period in determining the long-term outcome of the U.S.-China techno-security race. As China continues to ramp up its SAMI model and pour ample resources and talent into this effort, the United States also needs to significantly raise its material and political support for its STI system. But the opposite appears to be happening as the second Trump administration has begun to significantly cut back federal funding for science and technology research and reduce and disrupt the ability of top research universities to conduct cutting-edge research.[47] If these dynamics persist, China may reach U.S. levels and move ahead sooner rather than later.

One policy recommendation is offered here for the United States in this unrelenting contest with China for global technological leadership and long-term dominance. The American STI system is increasingly showing its age and needs a far-reaching makeover rather than the incremental reforms that have been carried out so far. The United States needs to make the management of STI policy matters a much greater and integrated leadership concern. The present situation suffers from endemic bureaucratic fragmentation among numerous competing departments. Moreover, the principal entity responsible for STI matters, which is the White House Office for Science and Technology Policy, is small and low-ranking in the official hierarchy.

While the United States does not need to follow the path taken by China to establish a highly centralized and powerful STI leadership and management apparatus, having a dedicated STI organization with a powerful head who is of cabinet rank and who has the political clout and scientific expertise to coordinate and lead STI policy matters would be a significant upgrade to the organizational ability of the United States to compete with China for STI leadership. A pertinent role model is Vannevar Bush, who played a key role in the rise of the U.S. strategic STI system during World War II. Having a high-level STI entity in charge will allow the United States to more effectively manage its national innovation system and allow it to keep abreast if not stay ahead of the increasingly rapid and transformational changes that are taking place.

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[47] Proposed U.S. federal funding for science in the 2026 fiscal year would be 22 percent less than in the prior year according to an analysis by the American Association for the Advancement of Science. William Broad, "Trump Seeks to Cut Basic Scientific Research by Roughly One-Third, Report Shows," ***New York Times,*** July 10, 2025, https://www.nytimes.com/2025/07/10/science/trump-science-budget-cuts.html