

China's Roadmap to Becoming a Science, Technology, and Innovation Great Power in the 2020s and Beyond: Assessing its Medium- and Long-Term Strategies and Plans

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Summary of Key Findings

Part One: Track Record of the 13th Five-Year Plan

The 13th FYP was the first five-year plan that the Xi Jinping administration was responsible for drawing up and there was extensive continuity with the FYPs pursued by his predecessors. While the 13th FYP emphasized the importance of S&T innovation, top priority continued to be placed on economic growth. The 14th FYP though makes innovation the very highest priority for China's national development.

China met most of the S&T-related targets that were laid out in the 13th FYP. The most noteworthy achievements included the following: 1) climbing from 29th to 14th place in the Global Innovation Index, which is put together by the World Intellectual Property Organization, Cornell University, and the European business school INSEAD; 2) China became the world's leading filer of patents, and Huawei became the global leader for patent filing by companies; 3) China achieved its goal for the number of citations of its S&T publications, which propelled it to second in global ranking, close behind the United States.

Research and development (R&D) investment intensity was the only target that was not achieved in the 13th FYP. It reached 2.4 percent of Gross Domestic Product (GDP), narrowly missing the goal of 2.5 percent. While this 0.1 percent deficit appears trivial, it represents around RMB 100 billion or US\$15 billion, which is more than the combined budgets of the Pentagon's Defense Advanced Research Projects Agency and the U.S. National Science Foundation in 2020. China's absolute R&D spending is second only to the United States, and its goal in the 14th FYP of raising this funding by at least 7 percent annually over the next five years will bring China to parity with the United States both in terms of absolute investment and as a percentage of GDP.

Part Two: The 14th Five-Year Plan and the Status of the 2021-2035 MLP

Key Goals and Themes of the 14th Five-Year Plan

The 14th FYP signals that China will "stay the course" in the pursuit of the strategic vision and policies that Xi and his regime have established since coming to power in 2012. The underlying assumption running through the plan is that all of China's current policies are optimal and will be continued, and in some areas intensified. China is already on a road toward greater state control and a growing government push to control technology. By "staying the course," China is committing to traveling farther down that road, which will make the Chinese system even more unique and challenging and will inevitably increase international tensions.

Three key policy messages can be discerned from the 14th FYP. First, China will press ahead with, and intensify, its program of government-developed S&T and infrastructure construction; this in turn will require the government to exercise more comprehensive planning. Second, China currently lacks a vision of overall structural change in the economy and will temporarily ease up its efforts to drive structural change. Third, China will continue to combine market-oriented institutions with stepped-up planning and will continue to have an open economy to the extent possible. Chinese policymakers believe they have found a way to combine their increased steering of the economy with a market foundation, and they will seek to achieve their objectives in this environment.

The 14th FYP does not explicitly define a government-driven strategy, but the scope of China's ambitions and the type of instruments and interventions envisioned make clear that the government plays a pivotal, active, and expansionist interventionist role. This can be seen in five areas of the plan: 1) The plan calls for intensified investment in basic science, including an altogether new commitment to self-reliance in S&T; 2) Planners have laid out a strategic vision of "domestic circulation," in which the large and formidable domestic market plays an increasingly dominant role compared to international circulation; 3) China's ongoing industrial policies have all been reaffirmed and supplemented by an increasingly activist and transformative smart infrastructure investment program; 4) Regional land use and communications plans have much greater importance than ever before; and 5) China is unveiling a new vision of the 14th FYP that serves as an unifying vision for an entire system of specialized and local plans. These five dimensions add up to a sharply increased level of government intervention in the economy.

The 14th FYP provides a brief outline of a longer-term 2035 Vision that declares that China will "basically realize socialist modernization" by 2035. This means that the country's comprehensive national strength, of which economic, scientific, and technological capabilities are explicitly highlighted, will "rise sharply." Major breakthroughs in key core technologies will occur and China will reach the global innovation frontier. A modern economic system will be built from new modes of industrialization, informatization, urbanization, and agricultural development, which will allow China to reach the per capita income levels of a moderately developed country. China will also reach a higher level of security and stability, of which a key contributing factor is the "basic realization" of defense modernization. The Ministry of Science and Technology (MOST) has been leading an extensive effort to draft a detailed 2021-2035 MLP since 2019.

More than a quarter of the 14th FYP is concerned with matters related to technology, innovation, and security issues. The plan begins with a sober assessment of the "profound and complex changes" that China is facing in the international environment,

which has not been witnessed in a century. In other words, the external arena is more volatile and worrisome than at any time in the existence of the People's Republic of China, even during the Cold War days of bitter Sino-Soviet and Sino-U.S. rivalry. The developmental response has been to place science, technology, and innovation firmly at the commanding heights of the 14th FYP policy agenda. The plan points to the critical importance of “adhering to the core position of innovation in China’s modernization drive” and to “take science and technology independence and self-reliance as the strategic support for national development.”

National security also receives central billing in the 14th FYP compared to its cameo appearances in past five-year plans in the reform era. National security and economic development are treated as of coequal importance and the plan emphasizes the need to closely integrate these two domains. Key security-related themes addressed in the plan are technological self-reliance, economic securitization, industrial policy, and military modernization.

These themes offer important clues as to what the next stages of China’s techno-security grand development strategy will entail:

1. The urgent need to achieve techno-nationalist independence and self-reliance. The ease of access that China has had to foreign technology and knowledge over the past few decades has meant that self-reliance has been an aspirational long-term objective, but the rapid tightening of U.S.-led export controls since the mid-2010s has forced the Chinese authorities into concerted action to prevent technological “strangulation.”
2. Securitization of and increased orientation toward the domestic bases of the Chinese economy to balance against excessive reliance of an increasingly treacherous international economy. This is set out in the “dual circulation” concept in which “China will form a formidably large domestic market and create a new development framework.”
3. Continuing emphasis on the pursuit of industrial policy, especially in the advanced manufacturing and techno-industrial domains. The plan talks about the need for China to become a manufacturing superpower, although it avoids the use of terms that have sparked international backlash such as Made in China 2025 and Military-Civil Fusion (MCF).
4. While MCF as a phrase has disappeared from the 14th FYP, the pursuit of the convergence between the civilian and defense economies remains a pressing priority. The general objective outlined in the plan is to build an overarching

integrated strategic system in which the civilian, defense, and national security sectors are closely aligned and coordinated.

5. Accelerating the pace and scale of defense modernization, especially with the goal of “improving the strategic ability to defend national sovereignty, national security, and development interests” by the hundredth anniversary of the founding of the PLA in 2027.
6. The relationship between state planning and the market. The 14th FYP calls for the continuation of market reforms and opening up to international engagement as well as expanded state intervention and control of the economy.

The 14th FYP addresses supply chain issues extensively and much more broadly than standard frameworks of supply chain management. The plan declares that the “modernization of the production chain” is among China’s highest priorities over the next five years. The discussion of supply chains is wide-ranging and includes raw materials, manufacturing, and production, innovation, technology, R&D, design, and even marketing and services. There is also emphasis on securing entire supply chains in sectors where China has a lead or competitive advantage. Moreover, the 14th FYP highlights the domestic foundations of supply chain resiliency and the utmost importance of sovereign control and independence.

Status of the 2021-2035 Medium- and Long-Term Science, Technology, and Innovation Development Plan (MLP)

Drafting of the 2021-2035 MLP began in the fall of 2018 and there was regular media reporting of the planning activities of state agencies, academic institutions, and think tanks. This included the convening of high-level policy meetings and research projects to support the detailed formulation of the MLP. The COVID-19 pandemic appears to have significantly slowed down the MLP planning process in the first half of 2020, but work resumed from mid-2020 and senior officials talked about the urgent need to finalize the MLP along with the 14th FYP for Science and Technology as the drafting deadline neared in the fall of 2020.

The media coverage of the MLP planning process though was halted between late 2020 to June 2021, strongly suggesting that the authorities had thrown a cloak of secrecy around the program. Senior S&T officials said in the summer of 2021 that the new MLP would be released soon, but no details have been released as of the beginning of 2022. As other major S&T development plans such as the Science, Technology, and Innovation 2030 Program that was started in 2016 have not been publicly issued, the track record of the Xi regime indicates that the MLP will not be openly disseminated.

Part Three: Assessments of the Strategic Emerging Industries Initiative, Semiconductor Industrial Policy, and Science, Technology, and Innovation 2030 Program

The Changing Nature of the Strategic Emerging Industries Initiative

The Strategic Emerging Industries (SEI) Initiative is the work horse of Chinese industrial policy and dates back to 2010 when it was first established under the Hu Jintao/Wen Jiabao administration. The SEI Initiative has undergone three major changes since its creation. Between 2010 and 2015, the SEI program was a response to perceived opportunity in sectors newly emerging on a global scale. The SEIs were reshaped from 2016 to conform with the innovation-driven development strategy (IDDS). This second iteration was more coherent and internally consistent, but also more government dominated. In 2020, a third incarnation of the SEI program was rolled out incorporating still more government direction that was designed to respond to the technological challenge from U.S. sanctions.

Attention to the strategic components of SEIs has increased in this third round of adjustments to the SEI Initiative. China is now dramatically increasing its resource commitment to SEIs, even though the program has so far not been very successful. The initially market-based SEI program has now turned into a program that is predominantly government guided. A program initially targeted at vacant spaces and opportunities in the global landscape has turned into one focused on replicating existing production links and insulating China from the outside world. SEIs have survived and maintained their centrality, but only by being redefined into something quite different from their initial form.

Semiconductor Industrial Policy and the Rise of National Champions

The upheavals in the development of the Chinese semiconductor sector since the late 2010s offers a vivid example of the highly interventionist nature of industrial policy by the Xi regime, especially in the face of serious external threats. The Chinese authorities became alarmed by the threat of being choked off from access to semiconductor supplies from the United States and other Western states in 2018 after sanctions were imposed on Chinese telecom firm ZTE and subsequently to other Chinese technology firms such as Huawei. These actions spurred the Chinese government to intensify already extensive efforts to develop the Chinese semiconductor industry to ensure self-reliance. Between 2019 and 2020, hasty increases in incentives induced massive entry of newcomers into the sector. Most new firms were unqualified though, and the result was massive waste and little improvement in China's developmental effort. Many hugely expensive large-scale projects failed and the government had to step in to clean up the situation.

While there have been many losers, a small group of handpicked “national champions” have emerged as clear winners. They include the likes of Semiconductor Manufacturing International Corporation (SMIC), Cambricon, Verisilicon, Amec, HiSilicon, and Yangtze Memory Company (YMC). This portends a shift to more direct centralized state control and support over a smaller number of national champions.

Science, Technology, and Innovation 2030 Major Projects Program

The Chinese authorities launched a new long-term initiative on mastering core technologies in October 2015 called the Science, Technology, and Innovation 2030 (STI 2030) Major Projects program. STI 2030 covers sixteen large-scale megaprojects that include aircraft engines and combustion turbines, technologies for deep-sea exploration and deep-sea stations, quantum communications and quantum computing, neuroscience and brain-related research, cybersecurity, deep-space exploration and in-orbit spacecraft, clean and efficient use of coal, smart power grids, space-earth integrated information network, intelligent manufacturing and robotics, and key new materials research and applications. In explaining this program, Xi Jinping has said that it was needed to help China “capture the science and technology strategic commanding heights.”