

Innovation

How China is Biting the World in Science and Technology

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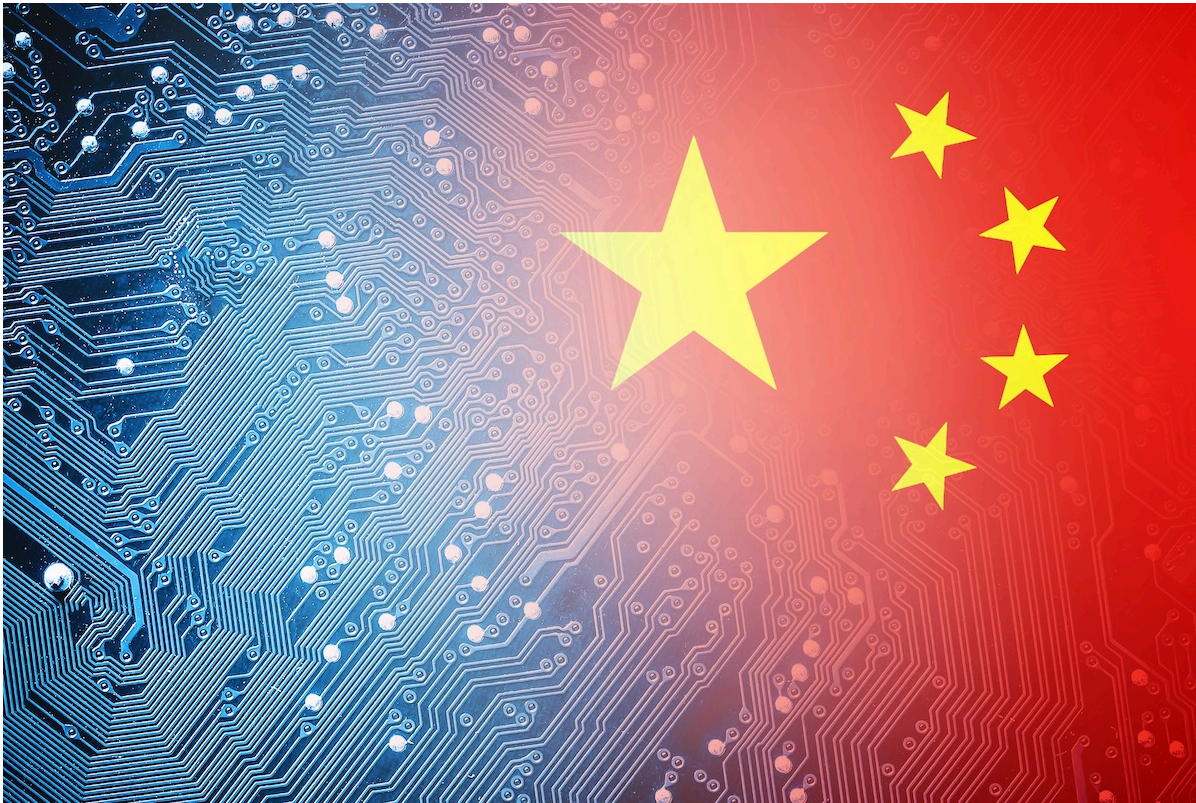


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From “world’s factory” to a formidable global science and technology powerhouse.

Over the past decade, China has transformed from a “world’s factory” into a formidable global science and technology powerhouse. DeepSeek, TikTok, CapCut, Shein, Temu, BYD, DJI, and Huawei illustrate how **Chinese technology** is permeating global markets and directly challenging the supremacy of established high-technology powerhouses. The Harvard Business Review article titled “*Why China Can’t Innovate*” appears to have lost its validity within just a decade. Once dismissed as a copier of Western innovation, it now leads in artificial intelligence research, quantum communication, space exploration, and clean energy technologies. According to the Global Innovation Index 2025, China ranked **10th** globally, entering the top 10 in innovation for the first time. The question for executives, policymakers, and entrepreneurs worldwide is no longer whether China is catching up, but how its scientific and technological “bite” is reshaping the global order — and what this means for competition, collaboration, and strategic choices. This article untangles several pressing issues underlying China’s rapid ascent in science and technology and the following table summarize the core initiatives for this purpose.

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Christopher Marquis et al., “**Regulatory Uncertainty and Corporate Responses to Environmental Protection in China**,” *California Management Review* 54, no. 1 (2011): 45.

Shaomin Li, “**Why Is Property Right Protection Lacking in China? An Institutional Explanation**,” *California Management Review* 46, no. 3 (2004): 102.

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Channel	Description / Examples	Impacts & Risks
State-driven strategy & policy	China's leadership treats science & tech as core to national power. The "whole-of-nation innovation" approach ties government, industry, military, and universities in coordinated tech push. Programs like <i>Made in China 2025</i> explicitly target upgrading manufacturing and pushing domestic capability in strategically important. The Chinese government in 2024 announced large boosts in R&D spending (e.g. +10 %) and support for AI, quantum, biomanufacturing, etc.	State direction ensures scale, consistency, and alignment of resources behind strategic goals. But it also concentrates risk: misallocations, political distortion, or bureaucratic inefficiency.
R&D investment & scaling capacity	China is pouring resources into science, technology, infrastructure, labs, and human capital. It has expanded capacity in manufacturing advanced electronics, batteries, solar panels, EVs, etc. China has also boosted basic science projects and national labs, integrating priority fields with state mobilization.	This gives China the production scale, cost advantages, and faster iteration cycles. Over time, it strengthens China's ability to define global supply chains.
Scientific publishing & knowledge leadership	In international collaborations and publications, China is closing the gap with established powers. A recent paper shows Chinese scientists have narrowed their leadership deficit in global collaboration networks, and China may match the U.S. in leading bilateral collaborations within a few years. In AI research specifically, China's share of AI publications has grown strongly; in one 2025 study, China is approaching ~36 % global share of AI publications. In combined China-U.S. AI collaborations, the work is often more "impactful" than separate work, underscoring mutual dependence.	Over time, this shifts the scientific "center of gravity" — more citations, more expertise, more ability to shape research agendas, standards, and methods. It also helps China attract talent.
Talent mobilization & "brain gain"	China is trying to attract global STEM talent by policy (e.g. a new "K visa" for young STEM workers) and improved research conditions. Chinese talent abroad — in U.S., Europe, etc — play roles as bridges, returning with experience or collaborating. China invests heavily in STEM education, graduate programs, scholarships, and overseas study.	This helps reverse "brain drain" and improves domestic innovation quality. It also increases global ties and influence. But competition for top talent is fierce, and mobility restrictions in some countries may constrain this.
Technology diffusion and supply chain penetration	China has become deeply integrated into global supply chains and often dominates in intermediate goods, components, and manufacturing. In many emerging countries and less developed markets, Chinese technology (e.g. telecom infrastructure, solar panels, EVs, surveillance systems) is affordable and widely adopted. China sometimes uses "technology export + financing" packages to tied-deal partners (e.g. Belt & Road–style tech investment).	This gives China economic leverage, dependency, and co-development influence in many countries. As more regions adopt Chinese standards & systems, global interoperability and lock-in shift in China's favor.
Strategic decoupling & tech competition with the U.S.	China is under growing technology sanctions, export controls, and decoupling pressures from the U.S. and its allies. China reacts by "dual circulation" (emphasize internal supply, plus selective external engagement) and pushing self-reliance in key technologies (e.g. chips) to reduce vulnerability. Studies of U.S.–China S&T friction show that technology areas closer to basic science and those where China is nearer parity are most impacted by restrictions.	China's strategies encourage alternative supply chains, parallel standards, and sometimes fragmentation of global tech order. Also increases risk in cooperation, intellectual property disputes, and geopolitical competition.
Space, defense, advanced infrastructure	China has made notable progress in its space program: modular space station, lunar missions, satellite networks, Earth observation systems. It is also advancing in military-relevant tech: hypersonics, quantum sensing, AI for defense, surveillance systems, advanced materials. Infrastructure programs (e.g. high-speed rail, 5G networks) at home provide a testing ground and showcase for Chinese technological prowess.	These serve both prestige and strategic deterrence. They also help China create ecosystems where other countries adopt Chinese space/defense infrastructure (satellite services, remote sensing, etc.).

From Copycat to Cutting Edge. For years, China was accused of "copycat innovation." While elements of imitation remain, the country has moved firmly into cutting-edge research. It aims to become world leader in AI in 2030 as companies like Baidu, Alibaba, Tencent are

heavily investing in AI research. Firms such as Baidu, SenseTime, and iFlytek are global pioneers in facial recognition, natural language processing, and smart city applications. China's Micius satellite achieved the world's first quantum-encrypted intercontinental communication in 2017. This shift from imitation to innovation has repositioned China as not just a fast follower but, in many domains, a first mover.

Investment in R&D. China spends more than **2.6%** (close to EU 2.67% and not far from the United States (3.4 %) of its GDP on R&D. With an R&D workforce exceeding 5 million researchers, China's innovation capacity dwarfs that of entire continents. The government has declared self-reliance in science and technology as a matter of national security, placing it at the heart of the "Chinese Dream" of national rejuvenation. Chinese researchers **publish** more quantum-related research papers annually than any other country. Simalryl, Chinese AI companies **issue** more patents than any other country. In 2021, China accounted for **over 50%** of world total patent applications. Unlike fragmented Western systems, China's "whole-of-nation" approach enables rapid resource mobilization. According to multiple global innovation trackers, China now produces more high-impact research papers than the United States in several domains and leads in **37 out of 44** critical technology areas, ranging from advanced materials to renewable energy. China alone **produces** 80% of solar panel, 70% wind products, and 60% electric vehicles. China rules the sky when it comes to **drone**, three of the top 10 drone makers are Chinese. This meteoric rise is not accidental. It reflects deliberate strategy, massive investments, and a state-directed yet market-driven system that mobilizes resources with remarkable speed.

Infrastructure as a Force Multiplier. China has built world-class infrastructure to support science and technology: With over one billion internet users and the largest 5G rollout globally, China has created a domestic market where new digital applications can scale almost instantly. From massive particle accelerators to space laboratories, Beijing funds "big science" projects at a scale few nations can match. China's unparalleled supply chain ecosystems allow rapid prototyping, scaling, and commercialization of scientific breakthroughs. For global firms, this means China is not only a consumer market but also a laboratory where future technologies are tested and refined at scale.

Exporting Technology and Standards. China is not content with domestic dominance. It seeks to shape the world's technology landscape through three channels: Digital Silk Road projects provide partner countries with Chinese telecommunications, surveillance systems, smart city platforms, and fintech infrastructure. Huawei's 5G equipment, despite U.S. restrictions, is embedded across Asia, Africa, and Latin America. By actively participating in international standards bodies, China promotes its technical norms in areas like 5G, electric vehicle charging, and AI ethics. Winning in standards means influencing how future technologies evolve — and who profits. Chinese researchers collaborate globally, co-authoring papers, hosting international labs, and attracting foreign talent with generous funding and new "K-visas." This global embedding ensures that Chinese science is not isolated but central to worldwide networks.

Strategic Leverage: The Politics of Technology. China uses its tech power as geopolitical leverage. By dominating rare earth processing, it controls chokepoints in global supply chains. Through digital infrastructure exports, it gains influence over data flows in developing nations. Its space program, from BeiDou navigation satellites to lunar missions, offers not just prestige but also military and strategic capabilities. For Western policymakers, this dual-use character of China's science and technology bite raises security concerns. Export controls on semiconductors, AI chips, and defense-related technologies reflect an attempt to curb Beijing's rise. Yet restrictions often accelerate China's push for indigenous innovation. The bite, paradoxically, grows sharper under pressure.

Challenges and Contradictions. While publication numbers are high, questions remain about originality and breakthrough quality. Advanced semiconductor equipment and some biotech inputs still come from abroad, exposing vulnerabilities. Centralized targets sometimes reward short-term metrics over long-term scientific curiosity. Growing mistrust has led to tech decoupling, visa restrictions, and skepticism about collaboration. Building megaprojects and energy-intensive data centers strains environmental resources. These contradictions mean China's rise is not without risks — both domestically and globally.

How has China done all this? It is a part of long-term plan. For example, 2015, China set out an ambitious project called Made in China 2025 to turn from low-cost goods manufacturer to global tech leader. The plan sets out 10 target sectors with 250 mini goals and **86%** of them have been ticked off including far exceeding in some sectors such as electric vehicles and renewable energy. It uses state backed capitalism system whereby government sets out research agenda and subsequently funding agenda, bringing foreign researchers and acquiring foreign businesses and setting up joint ventures. According to US congress research, Chinese government planned to raise or spend **\$1.5 trillion** on grants for R&D or buying foreign companies. Huawei has become the top of world in 5G equipment and has huge market share in mobile phones, too. In 2023, it released a phone with microchip far beyond the rest of world thought it possible for the company or the country. China built the impressive bot, DeepSeek has shocked many due to low budget involved, Tiktok took west by surprise for its success over last decade globally. Shein and Temu are worthy challengers in ecommerce thanks to Chinese cheap goods and innovative technology. Moving beyond phone industry, Xiaomi has managed to build cars which got tremendous attention from customers. It diversified its businesses in toothbrushes, scooters, cat feeders, watches and even mattresses. When the U.S. restricted semiconductor equipment exports, Beijing responded with billions in subsidies, tax incentives, and directed investments to accelerate domestic chip fabrication. Scale is China's first weapon – and it is proving decisive.

What it means for Western Countries. For executives and entrepreneurs outside China, the country's science and technology bite carries five key implications. Chinese firms are no longer fringe players but global challengers in AI, EVs, renewable energy, and more. China's massive domestic market remains attractive for scaling products. But entry now often requires aligning with local ecosystems and data governance rules. China's control over critical materials and manufacturing means businesses must assess resilience. Diversification is essential, but decoupling is costly. Companies must monitor and engage with international standards processes, where China's growing influence can shape future technologies.



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