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Research article[1]

China's Science and Technology Policy and Its Outcomes

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Abstract

This article examines the main stages of China's science and technology policy and its outcomes in promoting technological and innovative development. Statistical data are presented, highlighting China's substantial progress in research, development, and innovation, which confirm the effectiveness of state-led initiatives. Special attention is given to the reforms in the scientific and technological sphere that marked the beginning of China's modernization strategy. The analysis demonstrates that China has not only strengthened its position as a global economic leader but also established itself as a driver of digitalization and scientific advancement.

Keywords: China, innovation, digitalization, digital technologies, science and technology policy

Introduction

China occupies a leading position in the global economy, demonstrating its innovative potential as the world's largest manufacturing and trading nation. The country actively supports the development of science, technology, and innovation. Research and development (R&D) expenditures have consistently increased over the past decade: in 2013, they amounted to 1.18 trillion yuan, while in 2022 they reached 3.09 trillion yuan, and by 2024 they had risen to 3.61 trillion yuan (Interfax, 2025; ISSEK, 2025). The share of R&D expenditures in gross domestic product (GDP) also grew from 1.99% in 2013 to 2.55% in 2022, reaching 2.68% in 2024. China's R&D investments are the second largest in the world, after the United States.

In 2024, China granted 1.045 million invention patents, representing a 13.5% increase compared to the previous year ("Legacy of the Dragon," 2024). In recent years, the country has achieved significant breakthroughs in computer technology and software development. For instance, China's share in the global semiconductor market increased 2.5 times, from 1.3% in 2020 to 3.2% in 2023 (Roscongress, 2025).

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The number of graduates in science, technology, engineering, and mathematics (STEM) fields has also grown, supported by national education initiatives. Currently, more than 40% of graduates specialize in STEM disciplines (Roscongress, 2025). Among China's notable achievements in 2024 was the Chang'e-6 spacecraft mission, which successfully returned lunar soil samples from the far side of the Moon—an unprecedented milestone in human history. Looking ahead, China plans to launch the Tianwen-3 mission to Mars in 2030, aiming to bring back Martian soil samples ("Legacy of the Dragon," 2024).

To achieve digital and technological autonomy, Chinese companies have introduced domestically designed computer hardware and operating systems. Huawei's HarmonyOS Next, for instance, demonstrates 20% higher energy efficiency and 30% better performance than Western counterparts, with enhanced data protection features (RBC, 2025a). In addition, China issued the world's first license for the mass production of unmanned aerial vehicles, projecting annual sales of up to 100,000 units by 2030 ("Legacy of the Dragon," 2024).

A remarkable event in 2025 was the launch of a conversational artificial intelligence (AI) model by the Chinese startup Deepseek. The system disrupted the global AI market and triggered a stock market downturn that reduced the combined wealth of the world's 500 richest individuals by USD 108 billion (RBC, 2025b). Between 2013 and 2023, more than 38,000 generative AI inventions were registered in China, six times more than in the United States. Furthermore, China has become the leading contributor of researchers specializing in AI, with its share growing from 29% in 2019 to 47% in 2022 (Roscongress, 2025).

These indicators demonstrate that China is not only strengthening its scientific and technological base but is also reshaping global technological competition. The following sections examine China's position in global innovation and digitalization indices in comparison with Russia, as well as the policy framework underpinning its success.

Results: Comparative Analysis of China and Russia in Global Innovation and Digitalization Indices

To assess the outcomes of China's science and technology policy, it is essential to examine the country's position in international innovation and digitalization rankings. The **Global Innovation Index (GII)**, published annually by the World Intellectual Property Organization (WIPO), evaluates national innovation capacity and performance.

Russia's position in the GII has deteriorated over the past four years, falling from 45th place in 2021 to 59th place in 2024 (WIPO, 2025). Several sub-indicators also declined. For example, international patent applications decreased by 10.3% between 2022 and 2023, while the number of scientific publications fell by 8.3%. Conversely, Russia showed improvement in the "Technology Adoption" sub-index, supported by moderate growth in labor productivity (0.6%) and life expectancy (3.8%).

By contrast, China ranked 11th in the 2024 GII, reflecting strong innovation capacity (WIPO, 2025). Although international patent applications and scientific publications slightly declined by 0.6% and 1.2%, respectively, R&D expenditures increased by 7.7%. Furthermore, technology adoption indicators showed robust growth: 5G deployment rose by 219%, electric vehicle adoption by 54.6%, and industrial robotics usage by 22.4%. China also reported labor productivity growth of 4.4% and a 0.5% increase in life expectancy, confirming the positive socio-economic effects of technological innovation. Within Asia, China ranked third, after Singapore and South Korea.

Another critical measure is the **ICT Development Index (IDI)**, compiled by the International Telecommunication Union (ITU). In 2024, China's IDI score rose to 85.8, while Russia scored higher at 90.6 (ITU, 2025). Despite this, China's score exceeded the average for upper-middle-income countries by 8.5 points, reflecting significant digital infrastructure development. Key indicators included near-universal 4G/5G coverage, high mobile broadband penetration, and relatively affordable internet services compared to income levels.

The **Global Digitalization Index (GDI)**, developed by Huawei, evaluates the maturity of digital economies across 77 countries. In 2024, China ranked 8th with a score of 69.2 out of 120, while Russia was not included in the ranking (Huawei, 2025). The United States (78.8), Singapore (76.1), and Sweden (74.5) led the index. China's strengths included "Ubiquitous Connectivity" (64.8), "Digital Foundation" (74.4), "Green Energy" (88.8), and "Supporting Policy & Ecosystem" (61.8). The findings suggest that for every one-point increase in digital maturity, China experienced a 5.4-fold increase in economic contribution. Moreover, every US dollar invested in digital transformation generated USD 8.3 in digital economic output.

Collectively, these indicators confirm that China has made substantial progress in innovation and digitalization, outperforming Russia in most global indices. While Russia demonstrates selective improvements, such as in technology adoption, China exhibits systemic development, driven by sustained state investment and strategic planning.

Discussion: Policy Framework, Stages, and Driving Factors

China's scientific and technological achievements are the result of a comprehensive and long-term state policy aimed at strengthening technological sovereignty and fostering innovation-driven growth. Since the mid-2000s, the government has implemented successive strategies that defined national priorities and mobilized resources toward science, technology, and innovation (STI).

Stages of Policy Implementation. The first milestone was the *Medium- and Long-Term Plan for the Development of Science and Technology (2006–2020)*, which emphasized reducing dependence on foreign technologies by 30% and prioritized sensor technologies, robotics, and augmented reality (Atomic Expert, 2025). In 2015, the *Made in China 2025* program sought to transform the country into a high-tech innovation economy by advancing next-generation information technologies, aerospace and aviation, biopharmaceuticals, and advanced medical equipment (TAdviser, 2025).

In 2016, high-technology priorities were integrated into the *Belt and Road Initiative*, promoting international cooperation through joint laboratories, research centers, and technology transfer hubs (Chen, 2022). By 2018, the *China Standards 2035* strategy aimed to shape global standards in emerging fields, including artificial intelligence (AI), the Internet of Things (IoT), 5G, cloud technologies, and biotechnology (Great Game Asia, 2025).

The *Dual Circulation Strategy* (2020) reinforced reliance on domestic markets and innovation while maintaining international engagement (Rossiyskaya Gazeta, 2024). The 14th Five-Year Plan (2021–2025) further institutionalized the principle of "self-reliance," setting the target that 10% of GDP should be generated by the digital economy (Chen, 2023). In 2023–2024, the government announced additional reforms to strengthen research and development (R&D), enhance private sector participation, and deepen modernization through strategic investment in AI, aerospace, new energy, and biomedicine (CGTN, 2024).

Driving Factors. Several internal and external factors catalyzed the adoption and evolution of China's STI policy (Chen, 2023):

- The necessity to enhance the competitiveness of the national technology market globally.
- The strategic goal of economic modernization and industrial transformation.
- Trade wars and sanctions targeting Chinese technology firms, particularly from the United States.
- Dependence on foreign technological standards and supply chains.
- The pursuit of technological sovereignty to safeguard national security.
- Lessons from the COVID-19 pandemic, which exposed vulnerabilities in import reliance.
- The *dual circulation* policy framework, which emphasized economic and technological self-sufficiency.

Strategic Outcomes

China's consistent emphasis on R&D investment, talent development, and industrial upgrading has positioned it as a global technology leader. Unlike economies traditionally reliant on low value-added production, China is transitioning toward innovation-driven growth. By prioritizing fundamental and applied research, cultivating high-skilled specialists, and promoting indigenous innovation, China aims to secure a sustainable role in global value chains, supply networks, and production ecosystems (Chen, 2023).

Conclusion

China's experience demonstrates that scientific and technological strength has become a central determinant of national power in the twenty-first century. Over the past two decades, China has moved from a manufacturing-based economy reliant on low-cost labor to an innovation-driven system that emphasizes technological sovereignty, digitalization, and global competitiveness. This transformation has been enabled by systematic state policies, significant investments in research and development, and a focus on cultivating a highly skilled workforce.

Although challenges remain in several sectors, China has already secured a leading role in global innovation indices, digital transformation, and patent activity. The integration of science, technology, and innovation into long-term national strategies has ensured resilience against external shocks, including sanctions and trade disputes. Moreover, China's policies illustrate how coordinated state action can accelerate industrial upgrading and enable the transition toward sustainable growth.

The Chinese case provides important lessons for other economies, including Russia, which can adapt aspects of China's innovation policies to strengthen domestic scientific capacity, enhance technological independence, and stimulate long-term economic development.

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