China 2050: Postprint of Fully Building a World Science and Technology Innovation Powerhouse

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Abstract

The grand blueprint and strategic plan proposed by General Secretary Xi Jinping in the report of the 19th National Congress of the Communist Party of China for building China into a great modern socialist country that is prosperous, strong, democratic, civilized, harmonious, and beautiful by the mid-21st century has ushered in a new era of comprehensively building a world power. As an important component of building a great modern socialist country, the realization of the strategic goal of becoming a world leader in science and technology innovation and the choice of development path have undoubtedly become the top priority in China' s current science and technology endeavors and the implementation of the innovation-driven development strategy. This article, from the broad context of building a great modern socialist country, and through reviewing the trajectory of China' s science and technology development and strategic path choices, prospectively discusses the policy and path choices for China to become a world leader in science and technology innovation by 2050 from multiple perspectives integrating talent, science and technology, economy, and industry, and proposes that the institutional advantages of socialism with Chinese characteristics constitute the greatest guarantee for achieving this goal by 2050.

Full Text

2050 China: Fully Building a World Sci-Tech Innovation Superpower

Abstract

General Secretary Xi Jinping put forward the grand blueprint and strategic layout in the 19th National Congress of the Communist Party of China (CPC) that by the middle of the 21st century we will develop China into a great modern socialist country that is prosperous, strong, democratic, culturally advanced,

harmonious, and beautiful, hence commencing a new era of building a world superpower. Sci-tech and innovation strength is an essential part of that. Consequently, the accomplishment of the strategic objectives of building muscle in science, technology, and innovation and the choice of development path are no doubt among the top priorities to China' s current sci-tech construction and the implementation of innovation-driven development strategy. This article examines this macro context, reviews China' s scientific and technological development trajectory and strategic path choices, and prospectively discusses the policies and pathways for China to become a world sci-tech innovation superpower by 2050 from multiple perspectives integrating talent, science and technology, economy, and industry. It further proposes that the advantage of China' s institutional system represents the greatest guarantee for achieving this 2050 goal.

Keywords: world' s sci-tech superpower, great modern socialist country, innovation-driven, 2050

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Introduction

At the historical juncture of socialism with Chinese characteristics entering a new era, General Secretary Xi Jinping' s report at the 19th Party Congress formulated for the first time a grand blueprint and strategic arrangement for China' s socialist modernization from the present to the middle of the 21st century: from building a moderately prosperous society in all respects by 2020, to basically achieving socialist modernization by 2035 with substantial leaps in economic and sci-tech strength that place China among the front ranks of innovative countries, and ultimately to building a great modern socialist country that is prosperous, strong, democratic, culturally advanced, harmonious, and beautiful by 2050 [1]. This has inaugurated a new era of building a modern socialist superpower in China.

As a crucial component of this endeavor, building a world-leading sci-tech innovation power has become a top priority for China' s current scientific and technological work and the implementation of its innovation-driven development strategy. This article examines this macro context, reviews China' s scientific and technological development trajectory and strategic path choices, and prospectively discusses the policies and pathways for China to become a world sci-tech innovation superpower by 2050 from multiple perspectives integrating talent, science and technology, economy, and industry. It further proposes that the advantage of China' s institutional system represents the greatest guarantee for achieving this 2050 goal.

China' s Sci-Tech Development Path: Three Strategic Choices

From China' s scientific and technological development journey, three distinct path choices emerge for different stages of economic development. The first is the **following route**, where as a latecomer, China adopted a "learning by doing"approach through the introduction of foreign advanced technologies. This was not only necessary but also an essential process to overcome technological backwardness and close the gap with global frontiers. Through opening-up and leveraging its late-mover advantages, China effectively narrowed the distance with world sci-tech frontiers and shed its label as a technologically backward nation.

The second approach is the **"overtaking on curves" strategy**. Similar to how a race car driver closely follows the leader and uses superior skills to overtake on bends, China capitalized on opportunities when developed countries faced economic slowdowns after the international financial crisis. While their growth stagnated, China' s steady "progress amid stability" created excellent opportunities for sci-tech overtaking. This enabled China to catch up rapidly with the times, narrow gaps with world advanced levels, and begin forging its own unique path.

The third is the **path of forging a new trail**. Building upon the full absorption and introduction of world advanced science and technology, China must break away from conventional tunnel-following routes and directly carve out a new path. This involves creating a "Chinese innovation road" and achieving "leadership by changing lanes (or tunnels)"to create first-mover advantages, leading Chinese innovation and ultimately global innovation. This path represents the key to China' s success in building a world sci-tech innovation superpower by 2050.

China' s Current Position: Entering the Era of Building a Sci-Tech Superpower

Over the 40 years of reform and opening-up, China's science and technology have made substantial progress across all dimensions, fundamentally transforming the long-standing situation of being "poor and blank" and "large but weak." Particularly since the 18th Party Congress, the vigorous implementation of the innovation-driven development strategy has yielded even more fruitful results in building an innovative country, with major sci-tech achievements such as the Tiangong space station, the Five-hundred-meter Aperture Spherical Telescope (FAST), the Jiaolong deep-sea submersible, the Mozi quantum satellite, the Wukong dark matter probe, and the C919 large aircraft [1]. Facing this new historical period, we must first have a clear understanding of our own sci-tech development status. Relevant data show that China' s sci-tech strength has successfully risen to the world' s first tier, laying a more solid foundation for building a world sci-tech superpower.

Specifically, China' s progress is evident across multiple indicators: (1) According to the *2016 National Science and Technology Expenditure Statistical Bulletin* released by the National Bureau of Statistics, China's total R&D expenditure in 2016 reached 1,567.67 billion yuan, a 51.4% increase from 2012, accounting for 2.11% of GDP—surpassing the average level of the EU-15 countries (2.05% in 2015). (2) China has built the world' s largest R&D talent pool, with full-time equivalent R&D personnel reaching 3.85 million person-years in 2016, up 17.7% from 2012 and ranking first globally. (3) China' s basic scientific research capacity has improved significantly, with the number of highly cited international papers ranking second worldwide in 2017, entering a new stage of running alongside and leading in basic science frontiers, and transitioning from quantitative accumulation to qualitative leap and from point breakthroughs to systematic capability enhancement [6]. (4) In 2016, China filed 1.34 million invention patent applications, topping the world for six consecutive years; the number of valid invention patents reached 1.16 million, making China the third country with over one million domestic invention patents; China submitted 43,000 Patent Cooperation Treaty (PCT) applications, accounting for 18.5% of the global total and ranking third worldwide. (5) In 2016, national technology market transaction volume reached 1.147 trillion yuan, up 77.2% from 2012, with its share of GDP rising from 1.19% to 1.53%, making the R&D industry one of the fastest-growing

emerging industries. (6) In 2016, the value-added of China' s high-tech industries accounted for 5.08% of GDP, becoming an important pillar industry; in 2015, China' s high-tech industry value-added accounted for 29% of the world total, surpassing the United States and ranking first globally.

These achievements demonstrate that China has entered the era of building a world sci-tech innovation superpower and is accelerating the formation of first-mover advantages for comprehensively building such a superpower. China is transforming from a follower to a global innovation leader and a new world innovation center, with its position in the global innovation landscape continuously rising and its sci-tech contribution rate and international influence growing ever larger. This also means that within just over 30 years, China is fully capable of building a world sci-tech innovation superpower, providing powerful sci-tech innovation support for building a great modern socialist country that is prosperous, strong, democratic, culturally advanced, harmonious, and beautiful.

Policy Framework for Building a World Sci-Tech Innovation Superpower

Science and Technology as the Driving Force

Innovation is the primary driving force for development [3]. Science and technology must be placed at the core of national development, with emphasis on "two top priorities" : First, vigorously strengthen basic scientific research. By fully leveraging late-mover advantages in sci-tech innovation to further narrow gaps with global frontiers and actively create new advantages, China must transform from a "follower," "chaser," and "parallel runner" in science and technology to an "inventor," "innovator," and "pacesetter." This requires achieving forward-looking, original, and leading major sci-tech breakthroughs, shifting the innovation model from demand-driven to supply-driven sci-tech structural reform, enhancing original innovation capability from the source, and providing scientific and technological supply. Second, vigorously strengthen applied basic research. By implementing major national sci-tech projects, China should focus on breakthroughs in key generic technologies, frontier leading technologies, modern engineering technologies, and disruptive technological innovations [1], ensuring sci-tech development keeps pace with national economic development and achieving leapfrog development in applied basic fields. This represents China' s advantage in concentrating resources to accomplish major national tasks, strategic planning, and major national projects.

Industry as the Core

Industry is the core for achieving positive interaction between science and technology and industrial development. Taking *Made in China 2025* and new-type industrialization as opportunities, China must accelerate building a manufacturing superpower. Supported by a sci-tech superpower, China should lay a scientific foundation for developing advanced manufacturing and the new infor-

mation technology revolution amid the new round of global sci-tech revolution and industrial transformation, focusing on upgrading China' s position in global value chains. Simultaneously, the market must play a dominant role, particularly leveraging market mechanisms as the baton in sci-tech innovation to provide positive feedback mechanisms for innovation. This represents China' s advantages in strategic industries, major national engineering projects, and market competition mechanisms.

Economy as the Foundation

The economy provides the foundation for creating an environment conducive to sci-tech innovation. Since the international financial crisis, world economic growth has entered a downward trajectory, while China' s economic development has entered a new normal, with the growth model at a critical transition from factor-driven to innovation-driven, making the shift between old and new growth drivers urgent. Only by maintaining steady economic growth can China create a favorable environment for sci-tech innovation, and only through sci-tech innovation can China effectively promote the smooth transition between old and new economic growth drivers and achieve sustainable economic development. This reflects China' s economic scale advantage, "giant country" market advantage, and enormous social demand advantage.

Talent as the Foundation

Talent is the fundamental basis for cultivating first-class innovative personnel. The essence of innovation-driven development is talent-driven development [6]. Only by cultivating first-class talent can China fundamentally create a first-class world sci-tech innovation superpower. In building such a superpower, China must strive to build world-class universities and disciplines, cultivate first-class research talent, and produce first-class original and leading scientific achievements to guide global sci-tech development. Simultaneously, China must strengthen innovative enterprise development, cultivate first-class enterprise management innovation talent, and develop world-class innovative enterprises. More importantly, China must continuously strengthen exchanges with sci-tech advanced countries, attracting not only first-class overseas Chinese innovation talent but also global innovation talent, thereby both utilizing global innovation resources and exerting positive externalities from China' s sci-tech innovation for world development. This represents China' s human resource and talent advantages.

Conclusion: Institutional Advantages as the Ultimate Guarantee

The construction of a world sci-tech innovation superpower essentially represents China' s journey since reform and opening-up: a path of leapfrog innovative development from a weak sci-tech nation to a sci-tech power, and then to a

sci-tech superpower. The secret to success lies in implementing a "learning by doing" catch-up policy during the early stages of economic development, emphasizing the introduction and learning of world advanced science and technology to closely follow global sci-tech frontiers, thereby achieving leapfrog development from being "poor and blank" and "large but weak" to becoming a world sci-tech power. During the critical period of economic growth driver transition, China has implemented the innovation-driven development strategy, strengthened endogenous innovation capacity building, and strived for independent innovation by boldly forging a new "tunnel overtaking" path that predecessors have never traveled, transforming from a "chaser" to an "overtaker" and ultimately to a "leader."

The fundamentally decisive factor in this process is China' s unique institutional advantage. Only the socialist system with Chinese characteristics can effectively combine the two major advantages of concentrating resources to accomplish major national tasks and market-based resource allocation, fully leveraging China' s giant country market advantage, large country talent advantage, and large country resource advantage to provide fundamental institutional guarantees for building a world sci-tech innovation superpower.

Standing at this new historical starting point, we have every reason to be confident that under the correct leadership of the Party Central Committee with Comrade Xi Jinping at its core, and aiming at the strategic goal of 2050, China will forge a Chinese-characteristic innovation development path, make sci-tech contributions to building a great modern socialist country with Chinese characteristics, and exert significant "Chinese innovation" contributions to world economic development.

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Note: Figure translations are in progress. See original paper for figures.