People.cn
people.cn

Daily Weekly Magazine

Service

- Accelerating the realization of high-level scientific and technological self-reliance

China Economic Weekly July 15, 2024 Monday

Accelerating the realization of high-level scientific and technological self-reliance

Text | Liu Yuanchun Ding Xiaoqin

"China Economic Weekly" (July 15, 2024, Page 05)

Editor's note:

"Development and Transcendence - The Core Issues and Strategic Paths of China's Modernization" explains the significance, connotation, key issues and implementation paths of China's modernization from many aspects.

This article is excerpted from the chapter "Answering the Needham Mystery" (the content is slightly deleted). It analyzes the scientific and technological revival since the founding of New China, the new opportunities and challenges at present, and explores the path to accelerate the realization of high-level scientific and technological self-reliance and self-improvement, providing reference and reference for China to fully seize the major opportunities of scientific and technological development and return to the center of the world's scientific and technological innovation stage.

Since the 18th National Congress of the Communist Party of China, the Party Central Committee has placed scientific and technological innovation at the core of the overall national development, promoting China's scientific and technological strength from quantitative accumulation to qualitative leap, from point breakthroughs to system capacity improvement. Some key core technologies have achieved breakthroughs, and scientific and technological innovation has achieved new historic achievements. At the same time, we must also see that China's original innovation capabilities are not strong enough, the overall efficiency of the innovation system is not high enough, and some key core technologies are still subject to others. Therefore, it is necessary to accelerate the realization of high-level scientific and technological self-reliance and self-improvement, strengthen the construction of major scientific and technological innovation platforms, gather forces to carry out original and leading scientific and technological research, win the battle of key core technologies, and proactively layout strategic emerging industries to cultivate and develop future industries.

Use a new national system to help scientific and technological self-reliance and self-improvement

"Concentrate efforts to do big things" is a significant advantage of China's socialist system. In the 30 years from the founding of the People's Republic of China to the reform and opening up, China independently produced the "two bombs and one satellite" under the condition of low productivity and foreign technological blockade, and achieved a series of independent innovation results, showing the world the strong innovation ability of the Chinese nation. These achievements fully reflect the power of the national system of scientific and technological innovation. The national system in the 20th century was a national system under the planned economic system. In the 21st century, China has successfully established a socialist market economic system. Under the historical conditions that a new round of scientific and technological revolution is in full swing and the importance of scientific and technological competition in international competition is more prominent, China has followed the historical trend and proposed a new national system.

The "new" of the new national system is mainly reflected in the high degree of integration with the market economy, emphasizing both technology and market economic benefits. The organic combination of the role of the government and the market, from the administrative allocation of resources to the market playing a decisive role in resource allocation, can not only give play to the advantages of various subjects in collaborative research, but also respect the market law and give play to the market's resource allocation and optimization role. It can be seen that we have built a scientific and technological self-reliance and self-improvement research and development system characterized by the national system, as well as a market-oriented innovation system with a large market for large innovation and enterprises as the main body.

The national system can provide strong institutional support for scientific and technological innovation. Taking the chip industry as an example, the chip industry has the characteristics of large capital demand, high investment risk, and long return cycle, while social capital usually has a small capital scale and pursues high returns and liquidity, which cannot meet the requirements of new technology research and development in cutting-edge fields. Therefore, we cannot rely solely on market-oriented funds to support new technology research and development, but must also rely on the support of policy funds. At present, in the field of lithography machines, ASML, a Dutch lithography machine giant, occupies an absolute monopoly position. At the beginning of its establishment, ASML had only 31 employees and faced the dilemma of a broken

Micron Ex. 2014, p. 1
YMTC v. Micron
IPR2025-00098

capital chain. In order to develop EUV (extreme ultraviolet) lithography machines, it is necessary to solve the problems of both funding and technology. To this end, ASML pulled in 23.25 million euros of funds from the EU's Sixth Framework Program, used equity to raise 5.3 billion euros of research and development funds from Intel, TSMC, Samsung and other customers, and jointly carried out the Moore's Law Continuation Project with 3 universities, 10 research institutes and 15 European companies, which greatly promoted the development of EUV technology. After more than 10 years of continuous research and development investment, ASML delivered the world's first EUV lithography machine in 2010. Although Europe, Japan and South Korea had also explored EUV lithography technology before, they withdrew early due to huge research and development funds and difficult-to-cross technical bottlenecks, making ASML the only company in the world that can produce EUV lithography machines.

It can be seen that only through strong national power can scientific and technological innovation be better helped to overcome funding and technical difficulties. At present, the fierce international competition in high-tech industries requires a new national system to provide strong support for China's research and development of key core technologies, which can help Chinese companies like ASML overcome difficulties in the research and development process and shorten the research and development cycle. In September 2014, the National Integrated Circuit Industry Investment Fund was officially established. The fund is divided into two phases, with a scale of 138.72 billion yuan in the first phase and 204.15 billion yuan in the second phase. This fund with a total amount of over 340 billion yuan is the largest industrial investment fund in China and is known as the "chip big fund" in the industry. The big fund was jointly funded by the Ministry of Finance, China Development Bank Financial, China Tobacco, Yizhuang State Investment, etc., and the fund manager is Huaxin Investment. After the establishment of the big fund, it has provided strong support for the breakthrough of China's high-tech industry.

The independent innovation in the field of storage chips achieved by Yangtze Memory is an important achievement of the new national system. With the support of the big fund, Wuhan XMC and state-owned enterprises such as Tsinghua Unigroup jointly established Yangtze Memory in 2016. In addition, it also cooperated with the Institute of Microelectronics of the Chinese Academy of Sciences, Tsinghua University, Fudan University and other institutions to jointly develop related technologies of NAND Flash chips. After years of hard work and research and development, China has successively broken the international monopoly on 3D NAND and DRAM (dynamic random access memory), getting rid of the dilemma of being completely absent from the memory chip market in the past. As a leading domestic enterprise, Yangtze Memory has taken the lead in achieving breakthrough innovation in 3D NAND.

The operation of the first phase of the big fund has also encountered some twists and turns. This has made China realize that only capital investment is far from enough. It is necessary to strengthen the top-level design of the new national system and further gather more powerful national forces to carry out technical research to break the foreign technology blockade against China. On the one hand, while China's first phase of the big fund has orderly withdrawn, the second phase of the big fund quickly took over and accelerated the layout; on the other hand, it strengthened the leadership and support of the Party and the government for scientific and technological research. In 2023, the establishment of the Central Science and Technology Commission and the reorganization of the Ministry of Science and Technology indicate that China's new national system will be further improved and ready to go, and the cause of scientific and technological innovation will also be more powerfully led and promoted.

Strengthening the main position of enterprise innovation

Scientific and technological innovation depends on the output of basic research on the one hand and on the development of enterprise products on the other. Therefore, China must build a new scientific and technological innovation system, increase investment in basic research, and encourage enterprises to innovate. The 20th National Congress of the Communist Party of China emphasized the need to strengthen the leading role of enterprises in scientific and technological innovation. At present, China's scientific and technological innovation system has problems such as the difficulty in matching technology supply with industrial demand and insufficient integration of industry, academia, research and application. It is necessary to further strengthen the leading role of Chinese enterprises in innovation, connect scientific research with the market, and promote the effective connection between the innovation chain and the industrial chain.

First, we must further promote the deep integration and integrated development of industry, academia and research. Science and technology workers believe that the main obstacles to the transformation of scientific and technological achievements are the disconnection between scientific and technological achievements and market demand, the little effect of scientific and technological achievement transformation on improving the income of scientific researchers, the difficulty in evaluating the economic value of scientific and technological achievements, which makes it difficult for both supply and demand parties to reach a transaction, and the imperfect professional service system for the transformation of scientific and technological achievements. Therefore, we must further break through the barriers between universities, research institutes and the market, guide scientific research resources to the direction of market demand and potential, improve the review and evaluation system for technical patents, and promote the generation and application of

Micron Ex. 2014, p. 2
YMTC v. Micron
IPR2025-00098

more major patents with actual economic benefits.

Secondly, we must focus on cultivating entrepreneurial spirit with innovative genes. Innovation is the core of entrepreneurial spirit. In the period of economic transformation, entrepreneurs need to have more responsibilities. At the same time, the development of entrepreneurial spirit also depends on a good innovation environment. We must have a clear recognition of the identity of entrepreneurs, and on this basis, handle the relationship between the market and the government. Socialist entrepreneurship is different from Western entrepreneurship, and the biggest difference is how to define the entrepreneurship of state-owned enterprises. The other side of advocating entrepreneurship includes special attention to state-owned enterprises: Issues such as the improvement of the internal governance system of new state-owned enterprises need to be further resolved.

Thirdly, we must continuously improve the business environment and protect the innovation achievements of enterprises. It is not difficult to see from the "Global Competitiveness Report" released by the World Bank that most countries that have mastered the core industries and core technology industrial chains are mainly high-speed developing countries with a good business environment. Among the top 30 high-speed developing countries, 73% of the countries have a very good business environment. In particular, scientific and technological innovation enterprises with high-tech as the leading technology require a large number of scientific and technological innovation personnel, relying on high-level enterprises, first-class universities, and good innovative incentives and tax systems, equity arrangements, etc. In order to meet the various needs of innovative enterprises, a good business environment is needed. For some innovative enterprises or strategic industries, the protection of intellectual property rights and patents is very important. Without good intellectual property protection, the patent results, inventions, new models and new technologies of innovative industries may be plagiarized in an instant, and it will be difficult for enterprises to truly make profits. At the same time, innovative enterprises must have an innovative financing system to match them, so that they can effectively disperse innovation risks and get full support from the capital market.

Since the reform and opening up, China has gradually established a basic economic system with public ownership as the main body and the common development of multiple ownership economies. It has unswervingly consolidated and developed the public economy, and unswervingly encouraged, supported and guided the development of the non-public economy. Whether it is state-owned enterprises or private enterprises, they must be encouraged and supported to strengthen scientific and technological innovation and enhance their core competitiveness.

At present, the main goals of the three-year action plan for state-owned enterprise reform have been completed, and a new round of state-owned enterprise reform is ready to go. It is necessary to accelerate the improvement of systems and mechanisms that are conducive to scientific and technological innovation in state-owned enterprises, focus on solving prominent problems such as mechanisms, investment, talents, and transformation that restrict enterprise scientific and technological innovation, give full play to the advantages of innovative talents, technology and capital reserves in important industries and key fields of the state-owned economy, and better realize the supporting role of scientific and technological innovation in promoting the high-quality development of the state-owned economy. It is necessary to establish and improve the incentive and guarantee mechanism for innovation in the state-owned economy, and provide a good research and development environment and scientific and fair incentives for scientific research output for scientific and technological talents.

Party committees and governments at all levels should actively solve the problem of difficult and expensive financing for private enterprises, focus on accelerating the construction of public service systems, promote the establishment of common technology service platforms for private enterprises, actively develop technology markets, and provide technical support and professional services for private enterprises' independent innovation. At the same time, private enterprises should also take the initiative to connect with the national science and technology development strategic goals, strengthen exchanges and interactions with governments, research institutes, and universities, give full play to their own advantages of flexible innovation mechanisms, be good at discovering and leading market demand, strengthen technical research, and improve the efficiency of transformation of new scientific and technological achievements.

Finally, it is necessary to establish and improve the collaborative innovation pattern between state-owned enterprises and private enterprises. State-owned enterprises have strong financial advantages and the ability to mobilize resources, while private enterprises are closer to market demand. Promoting collaborative innovation between the two is conducive to achieving complementary advantages of different ownership economies, strengthening resource integration in the whole society, and improving innovation vitality.

People.cn All Rights Reserved. Use without written authorization is prohibited.
Copyright © 1997-2022 by www.people.com.cn all rights reserved

Micron Ex. 2014, p. 3
YMTC v. Micron
IPR2025-00098