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Analysis of the Causes, Realistic Challenges, and Trends of U.S. Technological Decoupling from China

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Abstract: *On October 12, 2022, the White House of the United States released the National Security Strategy, which clearly stated that the next 10 years will be the "decisive decade" in the crucial stage of competition between China and the United States. The United States government has placed science and technology competition at the core of China-U.S. strategic competition. High technology is not only the foundation of global economic development, but also the core driving force for the strategic capacity building of major powers. The many realistic challenges caused by the technological decoupling from China by the United States have squeezed China's technological development and security space, and as a result, the technological cooperation between China and the United States in the high-tech field is facing many obstacles. In this regard, China should strengthen the mutually beneficial relationship between China and the United States in scientific and technological cooperation; Strengthen the research and development of core technologies, continuously enhance technological innovation and application capabilities; Adhere to multilateralism and promote high-standard opening up .*

Keywords: *Technological Decoupling; Small Yard, High Fence; Technology Security; Semiconductor Industry*

1. Introduction

In recent years, the United States government has placed science and technology competition at the core of China-U.S. strategic competition. In order to realize the strategic intention of restructuring the global industrial chain, it has squeezed China's science and technology security space to the maximum extent. The containment of China's economic and high-tech development by the United States is manifested in strengthening rules and alliance systems to maintain the United States' technological superiority, restraining China from improving its technological capabilities while also preventing China from acquiring and developing high-tech that is detrimental to the United States and its allies.

The Biden administration pays more attention to implementing a multi-level, multi-domain, and all-round strategy for competition with China, based on ideology and widely consolidating domestic consensus in politics. The "small yard, high fence" technology restriction policy implemented by the Biden administration towards China is an idea that the Biden administration tends to precisely constrain after listening to criticism and suggestions from various aspects [1] , in order to revise the Trump administration's comprehensive restriction and decoupling strategy for China-U.S. technology relations. By flexibly utilizing it to enhance the protection of its own technology and limit China's high-tech development space, the ultimate goal is to maintain its long-term competitive advantage and achieve the maximum sanction effect. With the increasingly tight export control restrictions imposed by the United States on China's high-tech sector, the scope of key technology boundaries in the "small yard" continues to be generalized, leading to many obstacles and a deep contraction of cooperation space between China and the United States in the high-tech field.

Technological decoupling broadly defined as the undoing of cross-border trade in high-tech goods and services [2] , which creates numerous obstacles to commercial activities and severely restricts normal economic interactions between China and the United States. The current U.S. technological decoupling measures from China not only include export control, investment restriction and import restriction of Chinese products and services to curb China's scientific and technological development, but also include expanding domestic investment in technology research and development and rational planning of

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personnel training, so as to effectively improve innovation capability and realize the competitive advantage of the U.S. in the field of emerging technologies.

2. Analysis of the causes for the technological decoupling of the United States from China

2.1. High technology has become the foundation of the global economy

The further development of globalization in today's world has prompted the reconstruction of the international division of labor pattern, and the geopolitical and economic pattern has also accelerated changes. High-tech and cutting-edge manufacturing have become the core driving force for the strategic capacity building of major countries, and they are also the key links to promote economic prosperity. By tracing the theoretical origins of "decoupling", it can be found that it is closely related to the economic ideas of the American school, such as placing more emphasis on the domestic market and encouraging trade protection, which laid the foundation for the United States' "decoupling" policy. The United States has continuously increased capital investment to promote scientific and technological development, which not only drives the growth of domestic productivity but also maintains its technological advantages.

China's position in the global industrial transfer is increasingly prominent, and the essence of the game between China and the United States lies in the industrial competition [3] . Therefore, China's rapid rise in the global industrial chain challenges the dominant position of the United States in the global industrial division to some extent, and the huge value-added benefits generated by technology make high technology become the foundation of the global economy. In the digital age, technology has become a key area of competition between countries, and achieving leadership in emerging technology fields plays an important role in obtaining huge profits, global market share, and standard setting. Countries have closely integrated technology protection with national strategies. It is crucial for promoting sustainable economic growth, and it is not difficult to understand why the United States has chosen to curb the development of China's high-tech industry.

2.2. "Technological decoupling" is an important means for the United States to maintain its hegemony

Technological security is closely linked to a country's political, military, economic, and social security. The development of science and technology is crucial for enhancing national competitiveness and maintaining national security. On October 12, 2022, the White House of the United States released the National Security Strategy, which clearly stated that the next 10 years will be the "decisive decade" in the crucial stage of competition between China and the United States, and emphasizes "out-competing China" in key technological fields [4] . Robert Gilpin, in War and Change in World Politics, also emphasizes the importance of economics and technology in the power advantage of modern states [5] . The narrowing gap in technological strength between China and the United States has deeply concerned the United States, which is more inclined to decouple from its "competitors" in cutting-edge technology fields where it has advantages or monopolies. This is a strategic lever to place it at a higher level to achieve its specific political goals. By continuing its structural power in the semiconductor field, the goal of maintaining America's technological advantage is achieved, which is also an important guarantee for the United States to maintain its hegemony. It is well aware that technological development plays a crucial role in national security and economic prosperity. Therefore, relying on its own technological advantages and strong control over global industrial transfer, the United States attempts to grasp the global value chain and strategic technological dominance.

2.3. The United States' threat perception of China's Science and Technology Development Deepens

Compared with traditional high-tech, emerging technologies have many uncertain factors, and the security issues involved in these technologies have led to a sense of "insecurity" in the United States. The so-called "China threat theory" has a large market in the United States, and the United States government is concerned that China may use high-tech to engage in illegal activities such as espionage, theft, and surveillance under the pretext of technological development, stealing U.S. national secrets or spreading a large amount of false information, thereby gaining a competitive advantage and even potentially leading to non-democratic global technological dominance. The report "Mid-Decade Challenges to National Competitiveness" , released by the U.S. think tank "The Special Competitive Studies Project" (SCSP) , argues that the United States is in a fierce technology competition with China and defines China as the largest economic competitor and technology peer. The Carnegie Endowment

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for International Peace (CEIP) pointed out in the report "U.S.-China Technological 'Decoupling': A Strategy and Policy Framework" that in recent years, the United States has gradually seen technological interdependence with China as a major threat to the country and has begun to "technological decoupling" from China [6] .

The report "The Great Tech Rivalry: China vs the U.S." written by Professor Allison Graham's team at the Kennedy School of Government at Harvard University focuses on the fields of artificial intelligence, 5G, quantum information science, semiconductors, biotechnology, and new energy. By comparing and analyzing the development processes of China and the United States in these fields, it is believed that China's rapid development in these areas, and even surpassing the United States in some areas, will pose many challenges and threats to the United States' continued advantage in the field of technology [7] . The deepening of the U.S. perception of the threat of China's scientific and technological development has caused the U.S. government to attach great importance to the relative growth of power, and thus more inclined to use all kinds of "defensive" and "offensive" containment or suppression, with the aim of eliminating the existing threats or keeping the level of threats to a level that does not threaten the international order and rules that it dominates.

3. The realistic challenges caused by the United States' technological decoupling from China

3.1. "Exclusive technological multilateralism" form an external containment

The United States is attempting to establish a global order that can effectively contain China's technological development by leveraging its own technological advantages and its connections with allies. In June 2021, the United States and the European Union established the U.S.-EU Trade and Technology Council (TTC) , with the aim of strengthening cooperation between the United States and Europe in areas such as technical standards, global trade challenges and supply chain security, climate and clean technologies, data governance and technology platforms, technology abuse leading to security and human rights threats, export controls, investment reviews, and the acquisition and use of digital technologies by small and medium-sized enterprises. The United States leverages multilateral mechanisms such as the Indo-Pacific Economic Framework for Prosperity (IPEF) and the Quadrilateral Security Dialogue (QUAD) to strengthen cooperation in cutting-edge technology fields while promoting the formation of a technology blockade against China.

In September 2023, the U.S. Department of Commerce released the text of the IPEF Supply Chain Agreement, proposing relevant measures for each agreement country to improve supply chain transparency, diversity, security, and sustainability. And with the theme of "improving supply chain resilience and security", it promotes and encourages investment in critical sector, key goods production, digital infrastructure development, maintenance, and upgrading projects, emphasizing the goal of "reducing dependence on China" by strengthening supply chain cooperation in areas such as chips and key minerals. Technological decoupling has led to changes in the global technology ecosystem, increasing risks such as industrial chain disruptions. The various measures taken by the United States to restrict China's technological development will undoubtedly disrupt the security and stability of the existing global high-tech industry supply chain, and have a negative impact on the global economic situation.

3.2. Further escalation of containment in the area of cutting-edge technological

Previous U.S. governments have regarded decoupling as a strategic measure to address emerging technological challenges and a favorable means to contain China's development. In order to maintain its leading high-tech advantage, it has decoupled from China in the technology fields where it holds a leading advantage. In August 2022, Biden signed and came into effect the CHIPS and Science Act. In order to attract chip manufacturing companies to invest and build factories in the United States, the bill clearly plans to invest 52.7 billion U.S. dollars to incentivize research and development in the semiconductor industry in the United States. It should be noted that the bill considers research activities in the United States to have security risks, and specifically lists and elaborates on the research security section in its content, prohibiting researchers, contract workers, and visiting scholars employed by the U.S. federal government from participating in foreign talent programs [8] . This undoubtedly has a negative impact on the scientific research cooperation between China and the United States, as well as China's overseas talent introduction.

The Bureau of Industry and Security (BIS) of the U.S. Department of Commerce has included various

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Chinese technology entities in the "Entity List" on the grounds of endangering "U.S. national security or U.S. foreign policy interests". On October 7, 2022, the Biden administration released export control rules for advanced computing and semiconductor manufacturing, strengthening its control over the semiconductor industry from various aspects such as expanding the scope of controlled items, and strengthening control over end-users and uses. Not only that, BIS issued rules on October 17, 2023, further upgrading the chip control parameter indicators and resetting the high-performance computing chip parameters under the export control category ECCN 3A090, focusing on two key indicators: "total processing performance" and "performance density", and continuing to expand the control scope of semiconductor manufacturing equipment [9] . On March 29, 2024, BIS announced an interim final rule that corrects and revises the controls in the Export Administration Regulations. The noteworthy changes include the addition of new ECCN 4A090.b and the division of License Exception Notified Advanced Computing ("NAC") into two separate license exceptions.

After the final rules of the "guardrails" clauses in the CHIPS and Science Act were issued, the scope of application of capacity expansion restrictions, cooperative research and development and technology licensing restrictions was further clarified and refined. By implementing various measures mentioned above, the U.S. government encourages leading semiconductor fabrication plant to invest in and build factories in the United States, while forcing them to reduce their production capacity in China, in order to enhance the United States' advantageous position in the semiconductor supply chain. The Biden administration's containment of China's semiconductor development has the logical characteristics of planning, targeting, and long-term.

3.3. Politicization of technical issues and obstruction of scientific research cooperation

In 2021, Biden spoke at the Summit for Democracy about the "challenges" to global democracy. In order to safeguard U.S. technological hegemony, he used the so-called "democracy" as an excuse for cooperating with allies and partners to reduce the possibility of some countries abusing high technology to suppress people's rights. The United States continues to politicize and instrumentalize the issue of technology, which undoubtedly has a far-reaching negative impact on global technological innovation and development.

From the perspective of scientific research cooperation, the exchange and cooperation between researchers from China and the United States play an important role in promoting global technological progress. But in fact, under the influence of the U.S. strengthened research security review, the exchange and cooperation of researchers between China and the U.S. has also clearly shown a downward trend, which can be clearly reflected in the change of the number of China-U.S. co-authored papers. Analysis based on SCI databases shows that from 2016 to 2019, the number of China-U.S. cooperative papers has shown a rapid growth trend, with an average annual increase of more than 5000 papers. However, in 2020, it only increased by about 400 papers compared to 2019 [10] . The growing trend of "pan-securitization" has not only led to the squeezing of China's scientific and technological development and security space, but also caused many obstacles to global scientific and technological progress.

4. Trends in the United States technological decoupling from China

4.1. The complete sense of technological decoupling is impractical

Scientific and technological and industrial superiority is an important means for the United States to maintain national security and social stability and to maintain its hegemonic position. But the complete sense of "technological decoupling" is impractical. On the one hand, from the economic point of view, financial capital is globalized and profit-seeking, coupled with China's super-sized market advantage, will inevitably prompt the United States of America's high-tech capital and enterprises into the Chinese market. In the digital age, technology and economic development are closely linked, and scientific and technological innovation plays a key role in national economic development. Technological decoupling is neither in line with the interests of long-term development of U.S. enterprises nor in line with the realization of their short-term economic goals. On the other hand, from the perspective of scientific development, academic exchanges promote cooperation between countries, no country can rely only on its own academic research. Therefore, technological decoupling is not in line with the laws of academic development, and it will also lead to a slowdown in global scientific and technological progress and a contraction in scale, while destroying the long-term "innovation ecosystem" and industrial competitiveness of the United States. Achieving this goal is costly and unlikely to be achieved.

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4.2. The containment in key technological fields will not change

According to the Carnegie Endowment for International Peace, the early U.S. decoupling from China was mainly a defensive policy, but since the Biden administration, the U.S. decoupling strategy from China has increased a large number of offensive actions. Specifically, it is reflected in the implementation of various policy measures to encourage domestic innovation and promote the improvement of the United States' own technological strength.

And the Biden administration's "small yard, high fence" technological suppression of China has led the U.S. decoupling from China to focus on emerging technologies such as artificial intelligence, chip design, quantum technology, and blockchain to maintain U.S. competitiveness in these advanced technologies. On May 11, 2021, 64 technology giants and chip makers announced the formation of the "Semiconductors in America Coalition" (SIAC), with the aim of urging Congress to pass the 50 billion U.S. dollars semiconductor incentive program proposed by the Biden administration. In addition，U.S. Treasury Secretary Yellen put forward the concept of "friend-shoring", emphasizing the need to reduce the dependence of the industrial supply chain on China , in an attempt to reshape the spatial layout of global industries, with the aim of restricting supply chain outsourcing opportunities to so-called "friendly" or "trustworthy" companies.

In terms of technology investment, U.S. President Joe Biden signed an executive order on science and technology investment, which, through the establishment of an outbound investment review mechanism, restricts U.S. entities from investing and transacting in so-called sensitive high-tech areas including semiconductors, quantum computing, and artificial intelligence in China, which has had a number of negative impacts on the security and stability of China's industrial and supply chains. Under the pretext of maintaining so-called national security, continuously patching the "loopholes" in export control policies, overall, the containment posture in key technological fields will not change.

5. Coping strategy

5.1. Strengthen the mutually beneficial relationship between China and the United States in scientific and technological cooperation

The relations between China and the United States are among the most important bilateral relationships in the world. China is not only a major processor of U.S. technology products, but also an important consumer market for U.S. technology products, so there is great room for dialogue between the two sides in the field of science and technology. Nowadays, the challenges of global climate change, global health governance and other areas have intensified, and it is crucial to promote a healthy competition between China and the United States in science and technology. The two countries should respect each other's core interests, strive to clarify the national security boundaries in the field of science and technology, and seek common ground while reserving differences on relevant issues in the high-tech field.

Comprehensively analyzing the external environment of today's science and technology development, objectively assessing the latest status of China's scientific and technological development and formulating targeted response strategies are crucial for effectively breaking the scientific and technological containment. While strengthen the mutually beneficial relationship between China and the U.S. in scientific and technological cooperation, China should actively focus on and expand international cooperation between China and the U.S. in areas such as artificial intelligence governance, global climate change and healthcare, and further improve and liberalize foreign investment access in high-tech innovation.

5.2. Strengthen the research and development of core technologies, enhance technological innovation and application capabilities

The third-generation semiconductor is the core support for the seven major areas of "New infrastructure construction", meeting the major strategic needs of the country such as green development and intelligent manufacturing [11] . The "14th Five-Year Plan" National Research and Development Program have made it clear that the third generation of semiconductors as an important development direction. In view of the bottlenecks in technology research and development, in order to enhance the country's technological research and development and innovation capability, China should increase the support for key core technology research and development, focus on the industry's technological

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bottlenecks in production and market application needs, and make every effort to plough into the core areas to solve the "neck" of technological problems.

Based on the current stage and level of technological development in our country, we can clarify the large-scale systematic development of the third-generation semiconductor industry, fully deploy the core technology research and development of third-generation semiconductor materials, and strengthen the national strategic scientific and technological strength related to national security. At the same time, our government should pay attention to the macro layout of the future development of related technologies, so as to accelerate the deployment of the whole chain of industry, optimize the structure of scientific and technological innovation, and improve the management mode of scientific and technological innovation, so as to improve China's technological autonomy and realize the healthy development of industrial ecology.

5.3. Adhere to multilateralism and promote high-standard opening up

In response to the current conservative trend in cutting-edge scientific and technological innovation in the United States and Western countries, in order to improve the resilience and safety level of the industrial and supply chains, China can combine its unique advantages, adhere to the principle of enterprises as the main body, market as the guidance, promote the deep integration of industry, academia, research and application, and build an independent, controllable, safe and reliable industrial and supply chains . A comprehensive technology intellectual property rights protection system should be established, strengthen the maintenance and management of intellectual property rights, and protect our country's core technologies and innovative achievements.

Adhering to and practicing multilateralism is crucial, and international cooperation should be further strengthened. Relying on the "The Belt and Road" and other multilateral cooperation initiatives and cooperation platforms, China can grasp the opportunities for innovation while improving the construction of new cross-border platforms such as offshore innovation centers [12] , strengthen academic exchanges with outstanding scientific research talents from various countries, actively promote international scientific and technological cooperation, and innovate the mode of cooperation in order to achieve win-win cooperation.

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