WEP Warwick Evans Publishing

International Journal of Social Sciences and Public Administration

ISSN: 3005-9836 (Print), ISSN: 3005-9585 (Online) | Volume 6, Number 2, Year 2025
DOI: https://doi.org/10.62051/ijsspa.v6n2.21
Journal homepage: https://ijsspa.org

What Has the Chip War Brought to China's Chip Market?

Yining Zhao

School of University of Glasgow, Glasgow, UK

ABSTRACT

This study examines the escalating chip war between China and the United States, focusing on the impact of the chip war on the Chinese chip market. Through the case studies of Huawei and SMIC, this paper argues that although the chip war has brought obstacles and blows to China's chip market and enterprises in some aspects, from an overall perspective, the chip war has promoted the process of China's self-research and development of chip technology and the construction of domestic supply chain.

KEYWORDS

Chip War; Huawei; SMIC; Sanctions; Semiconductors.

1. INTRODUCTION

The escalating geopolitical, economic and technological competition between China and the United States is reflected in the now-much-concerned "chip war" incident. The US sanctions against China in the chip war have a profound impact on China's chip market. Semiconductors are the foundation of modern society, essential to everything from smartphones and computers to advanced military systems. In the past, the United States has been hegemonic in semiconductor technology and manufacturing, while China, although the largest consumer of semiconductors, lags far behind the United States in local supply chain production and technology .

Recognizing the strategic importance of semiconductors, the Chinese government has implemented initiatives such as the National Integrated Circuit Plan and Made in China 2025 [1]. These initiatives are aimed at achieving self-sufficiency and enhancing China's position in the global semiconductor industry. The U.S. government sees China's rapid development as a threat to its technological hegemony and national security, and has taken drastic measures to restrict China's access to critical semiconductor technology. These measures include placing leading Chinese technology companies such as Huawei Technologies Co LTD (Huawei) and Semiconductor Manufacturing International Corporation (SMIC) on the entity list, thereby restricting their access to US technology and components. In addition, the United States has used its influence to persuade Allies and partners around the world to restrict semiconductor exports to China. This has had an impact on China's development of its own semiconductor technology.

This study aims to analyze the impact of chip war on China's chip market through the study of two key cases (Huawei and SMIC). The two companies, Huawei and SMIC, represent the front lines of China's efforts to resist U.S. sanctions and maintain its ambitions in the semiconductor sector. Analyzing their strategic and operational responses has a profound role in studying the impact of the chip war on China's chip market.

Huawei, the world's leading telecommunications and consumer electronics manufacturer, has been a major target of US sanctions due to its significant progress in 5G technology and extensive global

market share [35]. The measures taken by Huawei in the face of US sanctions have a broad impact on China's chip market. Such measures, including self-development of chips, development of chip design software, and technology sharing with the domestic market, have promoted the restructuring of the domestic chip supply chain, and helped the domestic chip market get rid of US sanctions and reduce its dependence on US chip technology and equipment.

As the largest and most advanced semiconductor foundries in China, SMIC plays a crucial role in China's semiconductor strategy[13]. U.S. sanctions aimed at limiting SMIC's access to advanced manufacturing equipment and technology have dealt a blow to SMIC's capacity and output. But faced with the challenges of US manufacturing, SMIC chose to increase investment in independent research and development to help China's chip market wean itself off dependence on US chip manufacturing technology, manufacturing equipment and materials.

This study reviews the existing literature and materials on the background and reasons for the occurrence of chip wars and the sanctions imposed by the United States on Huawei and SMIC. These studies aim to gain a deeper understanding of the extensive impact of the chip war on China's chip market by studying the sanctions imposed by the United States on Chinese enterprises. It shows that although the US sanctions against China have indeed achieved some effects, including the interruption of supply chain in China's chip market, the lack of product output of enterprises and other negative effects. However, from the perspective of overall development, the impact brought by the US sanctions on China's chip market is more to stimulate the progress of Chinese technology enterprises' self-research and development of chip technology, and break the dependence of China's chip market on the US, and build a controllable domestic chip supply chain. In general, it has a driving effect on the future development of China's chip market.

2. LITERATURE REVIEW

In recent years, the chip war between China and the United States has become the focus of global attention. For both sides, the war involves not only actual economic competition, but also issues such as chip technology dominance and national security. This paper aims to analyze the impact of the chip war on China's chip market by studying the geopolitical background of the chip war, technological progress, and the strategic measures taken by the Chinese government and enterprises through the existing literature review. In the literature review section, this paper also studies the background and reasons of the chip war between China and the United States, so as to make it easier to understand and explain the impact of the chip war.

2.1. Background of Chip War between China and the US:

Although this study does not focus on the chip war itself, it is necessary to understand the background and development history of the Sino-US chip war before conducting this study to understand the reasons for the impact of the chip war on the Chinese chip market. The literature review section of this study is to understand the background, causes and development process of the chip war, which provides the background foundation for the research of this paper.

It is found that semiconductors are central to the development of modern science and technology, from consumer electronics to advanced computer systems, as well as in defense science and technology and critical infrastructure. However, in the international semiconductor market, the United States has long been the global leader in semiconductor design and manufacturing technology, while China is the world's largest semiconductor market. Until the early 2000s, China's electronics manufacturing industry began to boom, relying heavily on imported semiconductor chips. During this period, the Chinese government realized the importance of developing its own semiconductor industry, and began to support local enterprises and attract foreign investment into China's semiconductor market through various policies. Therefore, in 2014, the Chinese government issued

the "National Integrated Circuit Industry Development Promotion Outline" and set up a special fund to support and enhance the development of the domestic semiconductor industry, hoping to achieve self-sufficiency in China's semiconductor industry[2]. Secondly, in 2015, the "Made in China 2025 Plan" was put forward, which makes the semiconductor industry a key development project to reduce the dependence on foreign technology [1]. With the implementation of these policies and plans, China's importance in the global semiconductor industry chain has gradually increased, and the pattern of the global semiconductor industry has begun to change quietly.

Brief believes This shift in the global semiconductor landscape has prompted discussions on how the U.S. can sustain its competitiveness in semiconductor manufacturing (2022). In the face of the development of China's chip market, the United States has begun to worry about the degree of its control over key chip technologies. In early 2018, the U.S. imposed steep tariffs on Chinese imports. This also led to the escalation of the Sino-US trade war at that time, and the significant increase in tariffs became a sign of the intensification of the Sino-US trade war [11]. Later, in 2018, the US Department of Commerce placed a specific Chinese company, ZTE, on the "entity list", which prohibits US companies from selling or transferring technology and products to these companies without government permission. In 2019, the Bureau of Industry and Security of the US Department of Commerce added Huawei to the Entity List, which restricts Huawei's access to US technology and services, and will continue to expand the restrictions on Huawei in the coming years [63]. In 2020, Huawei was banned from using U.S. technology to produce semiconductors [63]. The Sino-US chip war thus kicked off, and will continue to develop in the next few years in the face of the expansion and development of US chip sanctions against China. In the face of this situation, after 2021, the Chinese government and technology enterprises began to continuously increase investment in independent chip research and development, actively develop semiconductor technology, and seek cooperation from other countries to reduce dependence on American technology. China's continuous development in chip technology has led to the tightening of the United States' chip sanctions against China. In 2022, Biden signed the Chips and Science Act, which continued to strengthen regulations and restrictions on chip production [15].

2.2. Reasons for the Chip War:

The reasons for the outbreak of the chip war are multi-dimensional, and one of the main driving forces of the chip war is the pursuit of technological hegemony. The United States maintains a leading position in semiconductor R&D and innovation. Although it outsources most of its manufacturing to other countries and regions (such as Taiwan's TSMC, South Korea's Samsung, etc.), it still controls the main technology and R&D in its own hands. As a major consumer and importer of chips, China's demand for chips continues to grow, but it is relatively backward in chip technology R&D and innovation, which stimulates China's demand for chip technology development. Therefore, the Chinese government put forward the policy of "Made in China 2025", which clearly proposed to achieve autonomy and control in the high-tech field, and catch up with the United States in the field of semiconductors, artificial intelligence and other fields, which poses a threat to the hegemony of the United States in this field. The US wants to maintain its leading position in the global science and technology field, and tries to prevent China's development in key technologies such as artificial intelligence, chip research and development, and 5G communication as much as possible, and tries to achieve this by restricting the export of high-tech products and technologies to China [25].

Another big reason for the US to launch a chip war against China is its concern over national security issues. A 2021 National Security Council report concluded that "if a potential adversary consistently outsmarts the United States in semiconductors, or suddenly and completely cuts off America's access to cutting-edge chips, It could gain the upper hand in every area of the war [31]. It's also why the U.S. government is trying to secure U.S. control in chip technology, and why countries that want to be seen as a threat to U.S. national security don't have access to these same technologies. And the U.S. government considers Chinese technology companies, including Huawei, SMIC and others, to be a

national security threat. These companies are believed to have close ties to the Chinese government and may conduct espionage-related activities through technological means[61,46].

The United States has imposed export controls and sanctions to curb China's access to advanced semiconductor technology, aiming to hamper Chinese advances in areas that could have military applications. Capri sees this strategy as part of a broader effort to maintain a technological edge and prevent potential adversaries from acquiring similar capabilities[5].

We also found in our research that economic competition is also one of the important reasons why the United States is waging a chip war against China. The semiconductor industry is an important pillar of the global economy, and the United States has a significant advantage in this area [4]. Huawei's rapid expansion in the global smartphone market and communication equipment market has threatened the market share of US tech giants such as Apple, Qualcomm and Cisco. So the US hopes to keep Chinese companies competitive in the global semiconductor market by restricting their access to advanced chip technology.

Geopolitical context

In the course of this research, it is found that the strategic competition between China and the United States also involves a broader geopolitical game. The semiconductor industry is an integral part of the global supply chain, affecting everything from consumer electronics to car manufacturing. The United States has been actively reshaping these supply chains to mitigate risks from geopolitical tensions[28]. Since controlling the semiconductor supply chain is critical to the country's military and economic security, the US has weakened China's influence in global geopolitics by suppressing the Chinese semiconductor industry. The sanctions against companies such as Huawei and SMIC are seen as part of a broader U.S. competition with China aimed at curbing the development of the Chinese tech industry and reshaping global supply chains. Geopolitical tensions have also been heightened by a broader struggle for global leadership. As a result, the chip war between China and the United States is not just a technological and economic competition, but a deep geopolitical game. The geopolitical factors behind the chip war are closely related to issues of national security, economic stability and global leadership. Both countries see technological dominance, particularly in semiconductors, as crucial to their strategic interests. As a result, the chip war is likely to continue to shape the global technology landscape, influence international trade policy and drive innovation in the semiconductor industry.

2.3. Relevant policies adopted by China and the US in the chip War:

This study argues that the measures taken by the United States to face the chip war are mainly to restrict exports. On October 7, 2022, the Bureau of Industry and Security (BIS) of the U.S. Department of Commerce announced an interim final rule (IFR) that "restricts the ability of the [People's Republic of China] to obtain advanced computing chips, develop and maintain supercomputers, and manufacture advanced semiconductors," To "protect the national security and foreign policy interests of the United States" [32]. These include the creation of an entity list, technology export restrictions, and more." Entity List restrictions are a necessary measure to ensure that China, through its national champion SMIC, is not able to leverage U.S. technologies to enable indigenous advanced technology levels to support its destabilizing military activities," Commerce Secretary Wilbur Ross said.[41]. The U.S. government put a number of Chinese technology companies on the entity list, including Huawei, ZTE, Semiconductor Manufacturing International Corporation (SMIC) and others, requiring U.S. companies to obtain separate licenses to do business with them, effectively blocking interactions between U.S. suppliers and Chinese companies, Has impacted a number of Chinese technology companies [43]. Second, the study found that the US government has also restricted the export of semiconductor technology, such as lithography machines and other related equipment, by banning the export of high-end chipmaking equipment and technology to China. This led to the loss of advanced chip manufacturing capabilities in China at that

time, which in addition to affecting the manufacturing and sales of existing products, also had an impact on the research and development of chip technology. In addition to these foreign policies, in order to enhance the international competitiveness of China's chip industry, the United States has also adopted a series of supportive policies. For example, in the Chip and Science Act passed in 2022, the government said it would provide $52 billion in funds to support the manufacturing and R&D of chips in the United States [47]. This includes direct subsidies to chip manufacturing plants, support for semiconductor research and development, and promotion of advances in chip manufacturing technology. At the same time, appropriate tax breaks and preferential policies for chip manufacturing enterprises should be provided to attract more chip manufacturing enterprises to return to the United States and set up production bases in the United States.

The Chinese government has also adopted corresponding policies in the face of the increasing pressure from the US government. In the face of the US government's export control, the Chinese government has increased its investment in independent chip research and development. Support for the development of China's chip industry through government financial support such as the National Integrated Circuit Industry Investment Fund [53]. Enterprises, including SMIC and Huawei, have received a large amount of financial support. Secondly, the Chinese government has strengthened scientific research investment in chip R&D and manufacturing, and encouraged universities and research institutions to cultivate more talents in R&D and manufacturing of related technologies, so as to provide a talent base for China's independent chip R&D. In order to reduce its dependence on US technology and equipment, China has sought more global partners, diversified its supply chain, strengthened cooperation with South Korea, Europe and other regions, and imported chip manufacturing equipment and technology. For example, China has partnered with European company ASML to purchase DUV lithography machines to enhance its local chip manufacturing capabilities.

2.4. Impact of Policies Adopted by China and the United States on the Global Chip Market:

The supply chain for chips is global, and chips, design software, chip design, semiconductor manufacturing equipment, facilities, testing and packaging plants, and end-use assembly may all come from or be located in different countries or regions [56]. In this study of the impact of the chip war on China's chip market, it is necessary to understand the impact of the chip war on the global chip market. The US export control on China has led China to seek new supplier cooperation in the global market, leading to the rearrangement of the global chip supply chain [57]. At the same time, the US's control on chips has led to insufficient market supply of related products and serious price fluctuations. For example, the US export restriction on computer graphics cards has led to the price rise of 40 series graphics cards in the Chinese market, which has even affected the automotive and industrial equipment fields. However, the Sino-US chip war not only brings fluctuations to the global chip market, but also promotes countries to realize the importance of independent chip research and development. All countries strengthen investment in chip technology research and development, and promote the rapid progress of global chip technology. This is very beneficial for the development of global chip technology. In general, the Sino-US chip war and related policies have had a profound impact on the global chip market. In the future, this field will continue to face new challenges and opportunities as technology advances and international relations evolve.

As one of the most important competitions in the global technology industry, the chip war between China and the US has had a great impact on the global chip supply chain. As the US has imposed chip export controls and technology export restrictions on China, China has taken a number of measures in response. These policies and measures have directly or indirectly affected the global supply chain. The chip war between China and the United States has led to the restructuring of the global chip supply chain. The US export controls on China have caused a number of chain reactions, and many chip manufacturers and technology companies have had to re-examine and adjust the structure of their supply chains. The first is that companies have made some adjustments to the

situation, seeking new partners to reduce their dependence on a single supplier or country. For example, in addition to its long-term dependence on TSMC, Apple has increased its cooperation with other chip manufacturers such as Samsung [58]. Many others are beginning to decentralize manufacturing and other parts of the supply chain globally. Places such as Southeast Asia, India and Latin America are emerging as new manufacturing and supply chain bases to reduce reliance on China's manufacturing base. At the same time, Chinese enterprises are also seeking new partners in other international markets to cope with the export sanctions imposed by the United States on Chinese enterprises [59]. In addition, one of the most direct impacts of the Sino-US chip war is the fluctuation of chip prices [60]. The Sino-Us chip war has led to the reduction of chip supply, the market demand exceeds supply, and the market price of high-end chips has risen. The rise of chip price leads to the price fluctuation of related products, which has a great impact on the global market. The direct impact of the chip war has led to fluctuations in the global supply chain and consumer market, but it has also stimulated the progress of global chip technology research and development. The US chip sanctions against China have made China and some countries realize the importance of mastering self-developed chip technology, forcing countries to increase investment in chip technology research and development, and promote global chip technology innovation and progress, such as the above mentioned US Chip and Science Act and China's Made in China 2025 plan [1]. In addition to the business and science and technology implications, the chip war has also had geopolitical implications.

The chip war between China and the US has made the semiconductor industry an important issue in international relations in recent years, prompting countries and enterprises to be more cautious and consider geopolitical factors when choosing partners. This trend could lead to the fragmentation of the global tech ecosystem and increase the complexity of technology standards and market access. In the context of fierce chip competition between China and the United States, other countries (Europe, Japan, South Korea, etc.) may choose to reach a technology alliance such as the United States to jointly restrict China. This technology alliance may lead to the differentiation of the global market, and to some extent, lead to "technology bullying" behavior. At the same time, geopolitical tensions will make international cooperation more difficult and complicated. As a result, when choosing international partners, enterprises should consider political risks as well as economic factors. In short, the Sino-US chip war has affected the global supply chain to varying degrees in many aspects, bringing both challenges and opportunities, promoting technological progress and market restructuring, and breaking the situation that the United States is the dominant player in the international chip market.

2.5. Conclusions So Far

In general, the Sino-US chip war is one of the events that have attracted much attention in the global trade arena in recent years. In addition to the event itself, the impact on China's supply chain is of great research value. The chip war between the two countries not only has an impact on their own policies, economy, technology and other aspects, but also has a non-negligible impact on other countries in the supply chain. These include the restructuring of the supply chain, the country's emphasis on independent chip research and development technology, and the increase of geopolitical risks. Through the study of the selected cases, it can be seen what types of strategies have been adopted and affected by both enterprises and countries in dealing with the challenges.

3. METHODOLOGY

3.1. Research Objectives

To analyze the specific sanctions imposed by the US on Huawei and SMIC.

Analyze the strategic measures implemented by Huawei and SMIC when they face US sanctions.

Dialectically evaluate the impact of chip war on China's chip market.

3.2. Research Methods

Qualitative analysis was used in this study, which was chosen to gain a more comprehensive understanding of the multifaceted factors of this complex phenomenon. This study investigates the response strategies adopted by the Chinese government and enterprises Huawei and SMIC in the face of US sanctions in the chip war, focusing on the impact of the chip war on China's chip market by studying the impact on Huawei and SMIC. The research objects of this study include policy documents, industry reports, industry news and expert interview records of both China and the United States. The data were collected mainly by means of literature analysis. The literature review in the first chapter mainly focuses on the background and reasons of chip wars, which lays the foundation for subsequent research. The second chapter focuses on two specific cases: Huawei and SMIC. To understand the sanctions taken by the US government and the response measures taken by the Chinese government and enterprises, the purpose is to analyze what positive and negative impacts the chip war has caused on Huawei and SMIC. The study is discussed in Chapter 3, and the conclusions drawn are around what impact the chip war has had on the Chinese chip market, and whether it has been positive or negative in general.

3.3. Reasons for Selecting Huawei as a Case Study

As one of the world's leading manufacturers of communication equipment and intelligent equipment, Huawei occupies a very important position in the global market[7]. Huawei's leading position in 5G technology, smart equipment and other fields has made it an important focus in the chip technology war between China and the United States. As a leading enterprise in China's smart equipment and chip-related industries, Huawei has been deeply and widely affected by the Sino-US chip war. A series of restrictions imposed by the United States on Huawei, including listing it on the entity list and restricting the sale of key chips and technologies to Huawei, have posed great challenges to Huawei's supply chain and product research and development. A study of the case of Huawei clearly shows the direct impact of these measures promulgated by the US on Chinese enterprises. Huawei's leading position in the world and its pioneering position in China's high-tech industry indicate its necessity in this study. As a Chinese technology company that relies on the international chip supply chain, Huawei's experience and countermeasures are very representative in China's chip industry [7].

Studying Huawei maps a range of responses in the Chinese chip industry as it faces external pressure. Huawei has an important share in China's chip market and technology industry, so the difficulties and transformation faced by Huawei have a profound impact on the balance between supply and demand, technological innovation and investment direction of the whole market. By studying Huawei, we can better understand the long-term impact of the chip war on China's overall economic and technological development. Another important factor is politics, with Huawei playing a key role in the trade and technology competition between China and the United States. Studying Huawei's case helps to understand the complexity of Sino-U.S. relations and how competition in the technology sector affects the international political and economic order.

In conclusion, the reasons and importance of Huawei as a study case lie in its industry leadership, the degree of impact, representativeness, the reference significance of response measures, the economic and technological impact on the market, and its special position in the China-US chip war relationship. By studying the case of Huawei, we can comprehensively and deeply analyze the multi-level impact of the Sino-US chip war on China's chip market and technology industry.

3.4. Reasons for Selecting SMIC as the Study Case

In addition to Huawei, the role played by Semiconductor Manufacturing International Corporation (SMIC) in the development of the chip war between China and the United States is also crucial. There are several important reasons for choosing SMIC as one of the case studies in this paper. SMIC's technology level, production scale and production capacity are representative of China's chip industry. Second, SMIC's significant position in the Chinese market has led to it being more targeted in the course of the Sino-US chip war, as the US sanctions policy has faced many challenges, including restrictions on access to advanced manufacturing equipment and key technologies [12]. Studying the case of SMIC can demonstrate the specific impact of US sanctions on China's chip manufacturing industry. In addition, SMIC is highly representative in the Chinese market and industry chain. As the largest chip manufacturer in China, SMIC is highly representative in terms of supply chain management, market demand and customer structure [34]. Its operating conditions and market strategies can reflect the advantages and disadvantages of China's chip industry chain in the international competition. Fourth, SMIC has received strong support from the Chinese government in the context of the Sino-US chip war, including support in terms of funds, policies and resources[12]. Studying the case of SMIC provides insights into the role of the Chinese government in the development of the chip industry and the effect of its policies. Smic's long-term development strategy and international cooperation layout are also representative, which has a significant impact on China's position and future development direction in the global chip industry. Research on SMIC can assess the competitiveness and cooperation potential of Chinese chip companies in the context of globalization. Another important point is their independent research and development and technological innovation. In the face of external equipment and technology blockade, SMIC has increased its investment in independent research and development and technological innovation. Its investment breakthrough in advanced technology represents the efforts of China's chip industry in technology independent research and development and industrial upgrading. Its progress in advanced process technology has a direct impact on the competitiveness and technological level of China's chip market. Analyzing its measures in technology breakthrough and R&D investment can provide an important reference for understanding the process of self-strengthening and localization of China's chip industry. Many of the risks and challenges SMIC faces, such as technology blockade, market competition and talent shortage, are universal and representative. By studying these issues, we can fully understand the vulnerability and coping strategies of China's chip industry in the international environment.

In conclusion, the importance of SMIC as a study case lies in its core position in China's chip industry, its representativeness affected by policies, a typical case of government support, the reflection of the market and industrial chain, and its key role in technological autonomy and industrial upgrading. By studying SMIC, it is possible to analyze the profound impact of the Sino-US chip war on China's chip market in an all-round and multi-level way.

4. FINDINGS

4.1. Overview

In the process of studying the Sino-Us chip war and its impact on the global chip supply chain, the actual case study is a very important research method. Case studies aim to gain insights into specific phenomena, generate and test hypotheses and theories, provide practical guidance, and explain causal relationships. Case studies are of great help to the ultimate purpose of this study. Most importantly, the actual case analysis makes the research more practical significance and application value, provides practical reference and guidance for policy makers and enterprises, and provides specific data and facts for the actual case analysis, which enhances the credibility and persuasion of the

research. This paper will study Huawei and SMIC, the participating enterprises in the Sino-US chip war, and analyze the impact of the Sino-Us chip war on Huawei and SMIC.

4.2. Case Study1 Huawei

4.2.1. Overview

The case study of Huawei is mainly based on the understanding of Huawei's development background, the sanctions imposed by the United States on Huawei, Huawei's countermeasures and the analysis of the impact of the sanctions imposed by the United States on Huawei. The study finds that the US sanctions on Huawei have caused Huawei to fall into the risk of supply chain disruption, and at the same time, it also faces the loss of market share and the hit of profitability. In order to cope with the US sanctions, Huawei has chosen to invest heavily in its own chip technology research and development, and at the same time, cooperate with the domestic government and enterprises to build a domestic supply chain, so as to reduce the impact of US sanctions on Huawei. In general, the sanctions of the United States have some negative impacts on Huawei, such as the above-mentioned supply chain disruption. However, in the long run, the sanctions of the United States have stimulated Huawei's independent research and development of technology, which is good for Huawei's future development.

4.2.2. Huawei's Development Background

Huawei Technologies Co., Ltd. was originally established in 1987 as a "private technology enterprise" with its headquarters in Shenzhen, China. It is the world's leading manufacturer of communication equipment and intelligent equipment [65]. Huawei started out as a trade and sales company, and then gradually developed into a global technology giant covering communication networks, IT equipment, intelligent terminals and cloud services. Through our research, we believe that Huawei's development process can be divided into three stages, namely, the initial stage (1987-1995), the international development stage (1995-2010) and the mature stage (2010-present).

Start-up period (1987-1995)

It is found in this paper that Huawei did not focus on scientific research and development at the beginning, but started as a sales agent of communication equipment, and then gradually entered the field of independent research and development, focusing on the R&D and sales of switches and routers and other equipment[65]. At first, Huawei relied on the agency and sales of HAX switches of Hong Kong companies as its main business until 1989, when it independently developed the first Huawei 24-port user switch [14]. Since then, Huawei began to embark on the road of independent research and development, and launched the self-developed C&C08 digital SPC switch in 1998, marking its rise in the field of communication equipment.

International development period (1995-2010)

We learned from the research data that Huawei started its layout in 1995, and began to plan to accelerate its entry into overseas markets in 1996, expanding into Europe, the Middle East, Africa and Asia, and gradually becoming an important participant in the global communication equipment market [44]. This is also confirmed by Huawei's entry into the International Telecommunication Union in 2001 [3]. In 2003, Huawei established Huawei Terminal Company focusing on mobile phone business, which filled the dead hole of Huawei's wireless solution. In the same year, Huawei established a joint venture company Huawei-3Com with 3Com Corporation to further enhance its competitiveness in the field of data communications [38].

Maturity (2010-present)

According to our research, Huawei's development began to mature after Huawei launched the first generation of Honor mobile phone in 2011. The launch of the first generation Honor phone marks Huawei's official entry into the smartphone market and its rapid development into one of the world's

major smartphone manufacturers. With its deep cultivation and development in the field of mobile phones, Huawei successfully became the third largest mobile phone manufacturer in the world after Samsung and Apple in 2015. At the same time, Huawei has increased investment in enterprise business and cloud computing to expand its business territory. Huawei has developed rapidly and occupies an important position in the world market. This is also the reason why Huawei has become the focus of the Sino-US chip war.

4.2.3. Specific Sanctions Imposed by the United States on Huawei

In the course of our research, we found and sorted out a series of sanctions imposed by the US government on Huawei in 2018. The specific sanctions imposed by the US government on Huawei cover various aspects, including restricting its purchase of US technology and products, prohibiting cooperation with US enterprises, and restricting financial services. In May 2019, the US Department of Commerce added Huawei and its 68 subsidiaries to the entity List, which prohibits US companies from selling products and technology to Huawei without government approval. Among them, US technology companies such as Qualcomm, Intel, and Google are prohibited from providing chips, operating systems, and other technical support to Huawei [63]. Then, in May 2020, the US Department of Commerce further scaled back the sanctions policy, stipulating that any company using US technology and equipment must obtain a US government license before supplying chips to Huawei. As a result, Taiwan Semiconductor Manufacturing Company (TSMC) was forced to stop producing advanced chips for Huawei, which had a serious impact on the chip supply for Huawei's high-end smartphones [22]. In August of the same year, the US Department of Commerce issued new rules prohibiting any product made using US software or technology from being supplied to Huawei, regardless of whether it is produced in the US or China. As a result, companies such as Samsung Electronics and SK Hynix are restricted from supplying memory chips to Huawei under the ban. In addition to directly restricting Huawei's access to chips and technology, the US government has also restricted the international financial transactions of Huawei and its affiliates through financial sanctions. As a result of the US government's interference, some international banks and financial institutions have stopped clearing and trading with Huawei for fear of violating US sanctions and regulations. On top of those restrictions, Huawei's 5G business has been dogged by Washington, which has aggressively lobbied Allies and other countries to ban the company from its 5G networks, saying its equipment poses national-security risks. That led countries including the U.K., Australia, Japan and Canada, under pressure from the U.S., to ban or restrict Huawei from participating in their 5G networks. Although Huawei became the preferred 21st century network provider for telecommunications as early as 2005, it also faced difficulties under the sanctions of the US government [3]. In addition to the sanctions imposed on Huawei itself, the US government also imposed personal sanctions on Huawei executives. In 2018, Huawei Chief Financial Officer Meng Wanzhou was arrested in Canada, and the United States filed criminal charges and extradition requests against her for alleged violations of U.S. sanctions on Iran, alleging bank fraud and sanctions violations [6]. The sanctions imposed by the US on Huawei continue to tighten, and in 2020, the US Department of Commerce even prohibited Huawei from using any electronic design automation (EDA) software containing US technology for chip design [27]. Huawei's inability to use EDA software from US companies such as Cadence and Synopsys has greatly limited its chip design capabilities.

These sanctions have significantly limited Huawei's ability to access key technologies and products globally, forcing it to adjust its business strategy towards independent research and development and localization. At the same time, these sanctions have also triggered extensive attention and adjustment of the global technology industry chain, which has had a profound impact on international scientific and technological cooperation and market pattern.

4.2.4. Countermeasures Taken by Huawei

Because Huawei initially relied heavily on technology and products from the United States and its related companies, the United States expected Huawei to gradually die out under its sanctions. However, Ren Zhengfei, Huawei's chief executive, told an internal meeting: "Huawei is fighting for its survival... As long as we survive, there will be a future." [37].

In the course of our research, we summarized a series of measures taken by Huawei in the face of US sanctions to meet the challenges and ensure the continuous operation and development of the company.

Through the study of relevant documents, we believe that the core measure taken by Huawei is to increase investment in research and development and strive to achieve independent innovation in key technologies. Huawei invests more than 10% of its revenue in R&D every year, and its R&D investment reached 131.7 billion yuan in 2019. Huawei has developed its own operating system, HarmonyOS, as an alternative to Android, and continues to innovate in 5G technology and AI. As of the first quarter of 2024, HarmonyoS 'market share in China reached 17%, surpassing Apple's iOS[21]. HiSilicon, a subsidiary of Huawei, has also stepped up its own R&D investment in chip technology, launching several high-performance chips, such as the Kirin series processors, for Huawei's smartphones and other devices [23]. In 2021, Huawei spent 142.7 billion yuan on R&D, accounting for 22.4% of the company's total revenue. Despite the decline in revenue, Huawei still maintained a high level of R&D investment[63] . And according to Caijing, Huawei cooperated with domestic EDA companies to develop MetaERP software, which "basically realized the localization of EDA tools above 14 nm" to replace the risk of relying on US software [18].

Secondly, in the face of the tightening sanctions policy of the United States, Huawei is facing the situation of supply chain interruption. Huawei has chosen to actively seek alternative suppliers to reduce its dependence on American products. Huawei has increased its procurement from Chinese local and non-US suppliers, such as cooperating with Semiconductor Manufacturing International Corporation (SMIC) to produce chips, to improve its local chip production capacity and reduce its dependence on US technology[50].

The third measure is that Huawei has also invested in a number of domestic technology start-ups through its investment institution "Hubble" to enhance the autonomous controlleability of the supply chain. For example, Hubble has invested in Focuslight Technologies and Suzhou Everbright Photonics to support the development of key technologies such as lithography devices and GAN chips [37].

4.2.5. Government Support

When studying the relevant literature on Huawei's response measures, we found that in addition to Huawei's own efforts, the Chinese government has taken a series of support measures to help Huawei cope with challenges and promote the development of the domestic technology industry.

Financial support

The Chinese government has provided huge financial support to Huawei through various channels, and only in 2022, Huawei received financial subsidies of 6.55 billion yuan (about 948 million US dollars) from the Chinese government, which are mainly used to support Huawei's investment in high-tech R&D and infrastructure construction [23].

Market protection and promotion

The Chinese government has encouraged state agencies and state-owned enterprises to buy more of Huawei's equipment and services. For example, government departments and state-owned enterprises have been instructed to use Huawei's telecommunications equipment to reduce their dependence on foreign technology [50]. This measure helped Huawei expand its domestic market share, and Figure 1 shows that Huawei's market share within China is still on the rise even after the US ban. Huawei

has also maintained its leading position in China's telecom market by providing high-quality network infrastructure equipment, and its 5G equipment still dominates the global market in 2021 and 2022 [63].

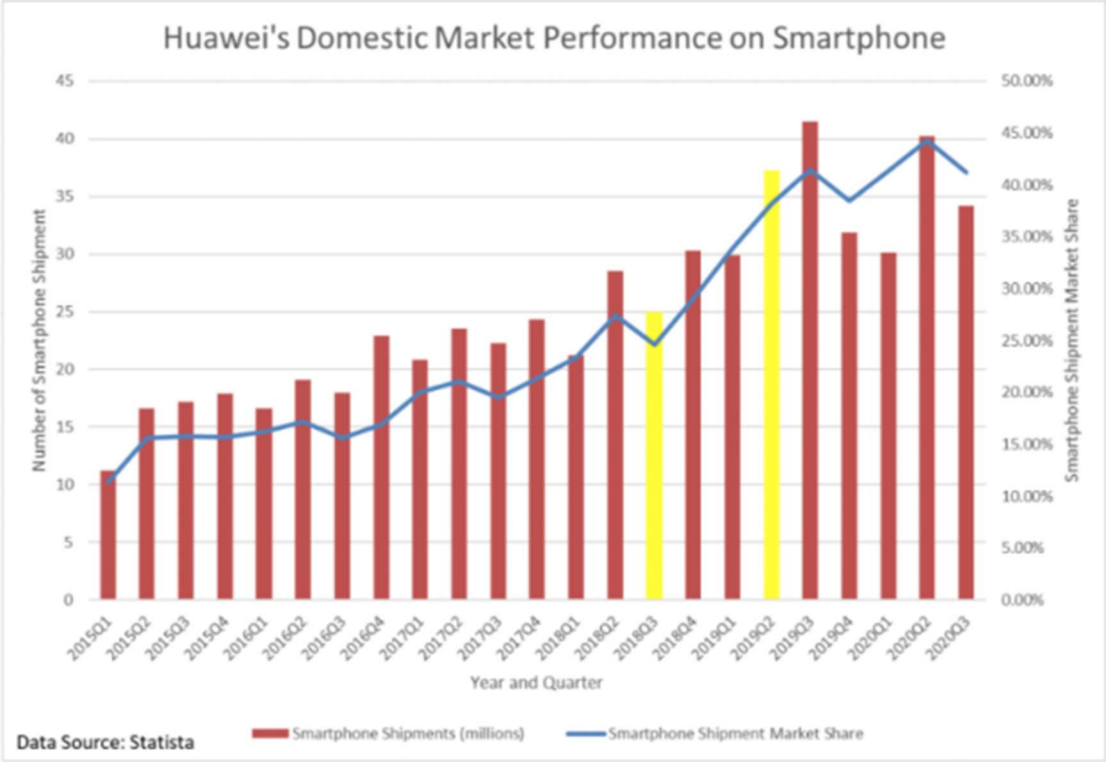

Figure 1. Huawei's Domestic Market Performance On Smartphone

Source: [10]

Judicial help

In addition, Huawei, with the support and help of the Chinese government, has actively used legal and diplomatic channels to win the support of the international community and partners and oppose the US sanctions.

These measures have helped Huawei maintain technological innovation and market competitiveness in the face of severe international sanctions, while promoting independent innovation and development of the domestic technology industry.

4.2.6. The Impact of Chip War on Huawei

Through the study of the US sanctions policy and Huawei's response measures, this paper finds that in the chip war, the US sanctions on Huawei have brought a broad and far-reaching impact on Huawei. These impacts include disrupted supply chain, decreased market share, impaired financial performance, and forced strategic adjustment.

First, we find that the most direct impact of US sanctions on Huawei is the disruption of Huawei's chip supply chain. In September 2020, TSMC stopped supplying chips to Huawei under the US sanctions against Huawei. TSMC's disconnection resulted in Huawei losing access to key 5nm and 7nm chips, which are essential for its high-end Mate and P-series smartphones [50].

For example, Huawei's Mate40 series, which was originally planned to be launched on a large scale in 2020, faced insufficient supply when it was launched due to US sanctions, which affected the brand image and Huawei's market share. As can be seen from Figure 2, Huawei's share in the global smartphone market in that year dropped from 17% in 2019 to 4% in 2021.

Characteristic	Samsung	Apple	Xiaomi	OPPO	vivo	Honor	Huawei
1Q '24	20%	17%	14%	8%	7%	6%	-
4Q '23	23%	16%	13%	7%	7%	5%	-
3Q '23	20%	16%	14%	9%	7%	6%	-
2Q '23	20%	17%	12%	10%	8%	4%	-
1Q '23	22%	21%	11%	10%	7%	5%	-
4Q '22	23%	15%	11%	10%	8%	4%	-
3Q '22	21%	16%	13%	10%	9%	5%	-
2Q '22	21%	16%	13%	10%	9%	5%	-
1Q '22	23%	18%	12%	9%	8%	5%	-
1Q '21	22%	17%	14%	11%	10%	-	4%
1Q '20	20%	14%	10%	8%	-	-	17%
1Q '19	21%	12%	8%	8%	-	-	12%
1Q '18	17%	11%	6%	5%	-	-	8%

Figure 2. Mobile phone shipments market share worldwide from 1st quarter 2015 to 1st quarter 2024, by vendor

Source:[42]

As we can see from our research materials, Huawei's sharp decline in the global smartphone market share has brought a significant loss to Huawei's revenue and profit. As can be seen from Figure 3, Huawei's operating profit in 2019 was 7.783.5 billion yuan, while its operating profit in 2020 dropped to 7.250.1 billion yuan. The operating profit margin also decreased from 9.1% in 2019 to 8.1% in 2020. According to Figure 4, Huawei's net financial income decreased by 29.6% in 2019 compared with 2018. All these indicate that the US sanctions against Huawei have seriously affected its production and sales of smartphones, resulting in a significant decline in profits. This has brought a big blow to Huawei, and Huawei has to carry out strategic adjustment and countermeasures.

Five-Year Financial Highlights

	2023		2022	2021	2020	2019
	(USD Million)	(CNY Million)	(CNY Million)			
Revenue	99,448	704,174	642,338	636,807	891,368	858,833
Operating profit	14,744	104,401	42,216	121,412	72,501	77,835
Operating margin	14.8%	14.8%	6.6%	19.1%	8.1%	9.1%
Net profit	12,280	86,950	35,562	113,718	64,649	62,656
Cash flow from operating activities	9,859	69,807	17,797	59,670	35,218	91,384
Cash and short-term investments	67,128	475,317	373,452	416,334	357,366	371,040
Working capital	59,550	421,662	344,938	376,923	299,062	257,638
Total assets	178,454	1,263,597	1,063,804	982,971	876,854	858,661
Total borrowings	43,556	308,414	197,144	175,100	141,811	112,162
Equity	71,682	507,568	437,076	414,652	330,408	295,537
Liability ratio	59.8%	59.8%	58.9%	57.8%	62.3%	65.6%

Note: Converted into United States dollars ("USD") using the closing rate at the end of 2023 of USD1.00 = CNY7.0808.

Figure 3. Huawei 2019-2023 financial highlights

Source:[17]

(CNY Million)	2019	2018	YoY
Net foreign exchange loss	**(1,340)**	(2,031)	(34.0)%
Other net finance gains	**1,518**	2,284	(33.5)%
Total net finance income	**178**	253	(29.6)%

Figure 4. Huawei 's Net finance income for 2019

Source:[16]

Secondly, in the face of sanctions, Huawei has to start to increase investment and R&D in other business areas and develop diversified business models, such as cloud computing, digital energy, smart vehicles and enterprise solutions [21]. These business adjustments and the development of new areas do help Huawei lift its predicament to some extent. Although it is difficult to fully make up for the losses caused by the smartphone business in the short term, in the long term, Huawei's digital cloud, smart car and other businesses do bring stable profits. As can be seen from the figure, in 2021, Huawei's profit did increase significantly to 12.141.2 billion yuan, and its profit margin also increased by 19.1%. However, most of Huawei's profit in 2021 came from a one-time gain from the sale of its Honor brand. Therefore, in 2019, the sanctions imposed by the United States on Huawei have brought great impact and loss, both in terms of profit and market share.

Thirdly, in the process of research, this paper finds that the most important strategic adjustment made by Huawei in response to the US sanctions is to increase investment in independent chip and technology research and development. As can be seen from Figure 5, driven by the gradually tightening sanctions policy of the United States, Huawei continued to increase its independent R&D investment in 2019, with the R&D expense rate reaching 13.165.9 billion yuan. Compared with 2018, the R&D expense investment increased by 29.7% year-on-year, and the R&D expense rate increased by 1.2% year-on-year. Although Huawei has increased its investment in independent R&D, it has been restricted in chip design, manufacturing equipment, materials and other aspects by the US, which has affected Huawei's R&D efficiency. As a result, it is more difficult for Huawei to develop chips independently.

(CNY Million)	2019	2018	YoY
Research and development expenses	**131,659**	101,509	29.7%
– as % of revenue	**15.3%**	14.1%	1.2%
Selling and administrative expenses	**114,165**	105,199	8.5%
– as % of revenue	**13.3%**	14.6%	(1.3)%
Other (income)/expenses, net	**(970)**	(1,824)	(46.8)%
– as % of revenue	**(0.1)%**	(0.3)%	0.2%
Total operating expenses	**244,854**	204,884	19.5%
– as % of revenue	**28.5%**	28.4%	0.1%

Figure 5. Huawei's Total operating expenses for 2019

Source:[16]

In addition to the effects mentioned above, the US government actively lobbied other countries to ban Huawei from participating in their 5G network construction, which resulted in Huawei's development in the international market being hindered. This is confirmed by the UK government's announcement in 2020 that it will phase out Huawei equipment from 2027 and ban the use of new

Huawei equipment in 5G networks [29]. As a result, Huawei's development in the global 5G market has been hit and hindered.

According to our research findings, the impact of US sanctions on Huawei is not all negative. The tightening US sanctions policy has promoted Huawei's independent chip research and development process. The Kirin 9000 chip developed by Huawei Hisilicon makes Huawei no longer affected by the US sanctions on mobile phone chips, and keeps Huawei competitive in the high-end smartphone market. By 2021, Huawei's self-developed Hongmeng operating system has been installed in more than 100 million units, helping Huawei maintain a high market share in the Chinese market and greatly reducing its dependence on US technology. To the success of independent research and development of chips, huawei huawei has extremely profound influence and the development of Chinese chip, greatly reduces the dependence on U.S. technology science and technology of China enterprises. Secondly, Huawei has invested in a number of Chinese domestic technology start-ups through its investment agency "Hubble", which is committed to supporting the localized production of lithography equipment and key materials for chip manufacturing [37]. Huawei's autonomy, these investments to enhance the domestic supply chain reduces the dependence on foreign suppliers and technology, and greatly promote the development of the domestic semiconductor industry. Through these measures and investments, Huawei has maintained its driving force for technological innovation and market competitiveness in the face of severe international sanctions. These efforts have not only helped Huawei weather the supply chain crisis, but also laid a solid foundation for its future development.

4.3. SMIC

4.3.1. Overview

In this part of the case study of smic's content, we through consulting relevant literature, public documents such as the information, to know that the development background of smic, smic case lays the foundation for research. In this part of the study, the differences in business types between SMIC and Huawei are explained, and the different impacts on companies with different business types are explained. This part of the study analyzes the sanctions imposed by the United States on SMIC, including joining the entity list and restricting the investment of American investors in SMIC, as well as the countermeasures taken by SMIC to increase the investment in technology research and development in the face of sanctions, and the financial and policy support provided by the Chinese government to SMIC. The impact of the chip war on SMIC, such as the negative impact of supply chain disruption, production capacity and output decline, operating profit loss, and the positive impact of promoting the R&D process of SMIC's chip manufacturing technology, R&D equipment and materials localization, are obtained. Overall, smic's own response measures and the Chinese government for its support, smic can get rid of the dependence on the equipment, technology.

4.3.2. Background

By studying the public information of SMIC, we have sorted out the development background of SMIC.

Smic's initial development was very rapid, but it also faced many difficulties. Smic was founded in Shanghai in 2000 by Dr. Rujing Zhang and a team of more than 300 Taiwanese engineers. In 2001, SMIC built its first wafer fab in Shanghai and started trial production. In the second year, SMIC's monthly output exceeded 100,000 sheets. In the third year, SMIC successfully became the fourth largest foundry in the world. After that, SMIC began to gradually expand its wafer manufacturing capabilities and technology, and gradually built new wafer fabs in Shenzhen, Beijing and Tianjin. From 2004 to 2010, SMIC continued to improve the technology level of wafer manufacturing, and gradually mastered advanced manufacturing technologies such as 90 nm, 65 nm and 45 nm [8]. Despite the continuous changes in production capacity and technology, it also experienced some blows during this period. In 2003, Taiwan Semiconductor Manufacturing Corporation, TSMC's North

American subsidiary, and WaferTech filed a number of patent infringement lawsuits against SMIC (Shanghai) and SMIC's US subsidiary in the U.S. District Court of California. In the complaint, TSMC claimed that SMIC improperly obtained TSMC's trade secrets and infringed TSMC's patents, and demanded compensation of US $1 billion from SMIC. The lawsuit continued until 2005, ending with SMIC paying $175 million and signing a settlement agreement that resulted in TSMC dropping the case [51]. But in 2006, TSMC sued SMIC again, accusing SMIC of failing to comply with the terms of the settlement. In 2009, SMIC reached another settlement with TSMC in which SMIC agreed to pay US $200 million in compensation and surrender a 10% stake to end the second lawsuit[52]. After that, SMIC, faced with fierce competition in the global semiconductor market, made more efforts in technological innovation and actively promoted the development of 28nm and below process technology. In 2015, it cooperated with Qualcomm to manufacture chips with a 28-nanometer process [54]. After mastering the 28nm process technology, SMIC gradually mastered the 14nm process technology, and began to develop the 7nm and below process technology. After that, SMIC was listed on Shanghai Science and Technology Innovation in 2020, which further enhanced its capital strength [55]. Smic has now become one of the world's leading semiconductor manufacturing companies, and continues to promote the research and development of advanced process technologies, such as 5-nanometer and 3-nanometer technologies.

4.3.3. Comparison with Huawei

In the research process of this paper, it is found that there are some differences between Huawei and SMIC. Semiconductor companies can be divided into three categories according to their business types. Those that are only responsible for semiconductor chip design but not manufacturing are called fabless semiconductor companies, such as Huawei Hisilicon, Qualcomm, AMD and NVIDIA; Second, is responsible for the design and to manufacture are called integrated device manufacturer (IDM), IDM companies vertical integration from chip design and manufacturing to encapsulate the whole process of test, have their own fabs and production facilities, such as South Korea's samsung, Intel, Texas instruments in the United States; And Foundries, such as TSMC and SMIC [19], which only provide chip manufacturing services and do not participate in chip R&D and design. SMIC and HiSilicon, which are also important players in China's chip industry, are very different. SMIC mainly provides semiconductor manufacturing services, focusing on wafer production, covering a variety of technology nodes from mature processes to advanced processes. Huawei HiSilicon, on the other hand, mainly focuses on the design and R&D of chips, with products covering communication, intelligent devices and other fields, while the chip manufacturing business is outsourced to other manufacturing enterprises including TSMC and SMIC[49].SMIC focuses on the production and manufacturing of chips, While HiSilicon focuses more on the design of high-performance chips, including the research and development of high-end chips such as Qolin series mobile phone chips and Kunpeng series server chips, which are widely used in Huawei's smart phones, wearable devices, server devices, network communications and so on [62]. In addition to the different technology R&D direction and business core, SMIC and HiSilicon also face very different challenges. SMIC is mainly facing the US restrictions on lithography machine and other related production equipment and materials, while Huawei HiSilicon is more facing the impact of US sanctions and needs to deal with the risk of supply chain fragmentation. The two also face very different markets. SMIC, as one of the world's leading chip founders, mainly provides production services for various Fabless companies, and Huawei Hisilicon also belongs to SMIC's customer group. And huawei haisi chip is mainly used for huawei's own products, also provides the solutions for other manufacturers, the main face of high-end chip technology research and development of the market, has the strong competitiveness in the field of communications equipment. Although SMIC and Huawei Hisilicon are both leaders in China's semiconductor industry, they are significantly different in business model, core competitiveness and market positioning. Smic focuses on foundry and manufacturing technology, while Huawei Hisilicon focuses on chip design and high-performance computing. Both companies face technological challenges and market competition in their respective fields, but are also pushing for independent innovation and industrial upgrading with the support of the Chinese government.

4.3.4. Specific Sanctions Imposed by the United States on SMIC

In our research, we found that the sanctions imposed by the United States on SMIC began in 2020. In 2020, the US government began to impose a series of restrictions on SMIC for national security reasons.

In September 2020, the U.S. Department of Commerce placed SMIC and some of its subsidiaries on the Entity List, restricting its purchase of certain high-tech equipment and products from U.S. suppliers [30].

In December of the same year, the U.S. Department of Defense further added SMIC to a list of "companies with ties to the Chinese military," prohibiting U.S. investors from investing in such companies [30]. This had a negative impact on SMIC's share price and access to financing. These sanctions primarily target SMIC's ability to acquire advanced semiconductor manufacturing equipment and technologies, especially those used to produce process nodes 10 nanometers and below. As a result, SMIC has faced obstacles in procuring core chip manufacturing equipment and materials such as lithography machines and etching equipment.

In August 2022, the U.S. further expanded the scope of the sanctions. The Bureau of Industry and Security (BIS) of the US Department of Commerce issued new rules prohibiting SMIC from acquiring critical manufacturing equipment and electronic design automation (EDA) software using US technology [64]. These limitations mainly aimed at 7 nanometer semiconductor production technology and the following process node. EDA software is a key tool for designing and manufacturing semiconductor chips, and US companies (such as Cadence, Synopsys, etc.) dominate this field. The move is aimed at limiting SMIC's capabilities in advanced semiconductor technologies.

A year later, in August 2023, biden government signed an executive order, further restrictions in China, including smic semiconductor, quantum information, and investment in the field of artificial intelligence. The move aims to prevent the capital flow is considered to pose a threat to U.S. national security of the foreign "focus on nation" [36].

4.3.5. Response

In the face of the US sanctions, we found and sorted out the strategic measures taken by SMIC in response to the US sanctions, as well as the financial, policy, talent and other support provided by the Chinese government to SMIC during the US sanctions.

SMIC's response measures

In the face of U.S. sanctions policy for smic, smic also carried out the corresponding measures to deal with it.

First of all, in the face of the United States to cut off the SMIC's supply chain, while at the same time facing the new flu pandemic bring economic pressure, SMIC remained high input to the independent research and development, efforts to a breakthrough on the key technologies. According to Figure 6 of SMIC's annual report, SMIC invested $677 million in R&D in 2020, which is almost the same as the amount invested in 2019. In addition to independent research and development, SMIC also actively carried out cooperation with Huawei in chip design and manufacturing technology to promote each other's technological innovation and independent research and development capabilities. According to the announcement of SMIC, in 2020, SMIC successfully mass-produced the 14nm FinFET process, and part of the capacity was used for chip manufacturing of Huawei Hisilicon [9].

For the year ended December 31

	2020	2019	2018	2017	2016
	(in US$ thousands, except per share, shares, percentages and piece)				
Revenue	3,906,975	3,115,672	3,359,984	3,101,175	2,914,180
Cost of sales	(2,986,062)	(2,473,213)	(2,613,307)	(2,360,431)	(2,064,499)
Gross profit	920,913	642,459	746,677	740,744	849,681
Research and development expenses	(677,413)	(687,369)	(663,368)	(509,356)	(370,764)
Sales and marketing expenses	(29,466)	(26,836)	(30,455)	(35,796)	(35,034)
General and administration expenses	(266,376)	(254,924)	(199,818)	(198,036)	(167,582)
Net impairment losses (recognized) reversal on financial assets	(199)	(1,076)	(937)	137	10,211
Other operating income, net	364,487	376,656	162,541	127,202	52,694
Profit from operations	311,946	48,910	14,640	124,895	339,206
Interest income	170,794	138,988	64,339	27,090	11,243
Finance costs	(73,234)	(63,460)	(24,278)	(18,021)	(23,037)
Foreign exchange gains (losses)	89,818	9,495	(8,499)	(12,694)	(1,640)
Other gains (losses), net	50,741	42,981	24,282	16,499	(2,113)
Share of gain (loss) of investment accounted for using equity method	187,343	5,362	21,203	(9,500)	(13,777)
Profit before tax	737,408	182,276	91,687	128,269	309,882
Income tax (expense) benefit	(68,310)	(23,416)	(14,476)	(1,846)	6,552
Profit for the year	669,098	158,860	77,211	126,423	316,434

Figure 6. Smic 2020 Annual Report2020

Source:[39]

Secondly, while investing more in R&D, SMIC accelerated the process of self-developed technology and domestic substitution in 2021 in the face of limitations in chip manufacturing equipment and technology. SMIC has established a partnership with Huawei to set up a 5-nanometer chip production line in Shanghai and plans to mass produce a new generation of Huaweh-designed chips using SMIC's existing U.S. and Dutch equipment, including ASML's lithography machines [48]. The measures to reduce the impact of the supply chain, to make the transition to independent research and development technology and domestic equipment replacement target.

Third, facing further tightening US sanctions in 2022, SMIC has also once again strengthened its investment in research and development. As can be seen from Figure 7, SMIC's investment in R&D increased from 638 million USD in 2021 to 733 million USD in 2022, representing a year-on-year increase of 14.8%. It also shows the smic in independent research and development and get rid of to the United States depends on the determination of the supply chain.

in USD'000

Year ended December 31,

	2022	2021	2022 as compared with 2021 (%)
Revenue	7,273,284	5,443,112	33.6
Cost of sales	(4,511,636)	(3,767,342)	19.8
Gross profit	2,761,648	1,675,770	64.8
Research and development expenses	(733,096)	(638,842)	14.8
Sales and marketing expenses	(33,834)	(27,642)	22.4
General and administrative expenses	(493,730)	(275,703)	79.1
Other operating income	335,296	657,982	(49.0)
Finance income, net	230,139	114,299	N/A
Other gains, net	26,763	80,785	(66.9)
Share of profits and losses of joint venture and associates	121,524	252,678	(51.9)
Net cash generated from operating activities	5,347,916	3,011,895	77.6
Net cash used in investing activities	(10,391,505)	(6,655,435)	56.1
Net cash generated from financing activities	3,614,290	2,357,325	53.3

Figure 7. SMIC 2022 Annual Report

Source:[40]

Fourth, in addition to its efforts in technology R&D, SMIC also raises funds through the domestic capital market to support technology R&D and capacity expansion. SMIC listed on the Shanghai

kechuang board in July 2020, raised more than 50 billion yuan, its to raise public capital is mainly used for advanced manufacturing technology research and development and the expansion of the production facilities. And, in SMIC kechuang board listing, huawei through direct investments and strategic partnership, provide financial support to SMIC, huawei through its investment directly involved in the part. This shows the expectation within the Chinese chip market to jointly establish a domestic supply chain and the desire to get rid of the shackles of the United States.

4.3.6. Government

During the period of US sanctions against SMIC, the Chinese government provided support to SMIC in many aspects, including financial assistance, policy support and technical support. These measures played an important role in the process of SMIC facing the US sanctions. In terms of financial assistance, the Chinese government has provided multiple financial assistance to SMIC through the National IC Industry Investment Fund (National Big Fund) and other channels to support its independent technology R&D and generation expansion, with the National Big Fund injecting more than US $2 billion into SMIC in 2020 .

In addition to financial support, the government also issued a series of policy support for development of smic, including preferential tax, land use policy and talent introduction plan, etc. Government to smic provides a number of preferential tax policies, including the reduction of enterprise income tax and research and development expense deductions, reduce the operating costs. In 2021, The State Council of China issued Several Policies to promote the High-quality Development of IC Industry and Software Industry in the New Era, which included eight supporting policies, including tax, reduction and preferential policies, investment and financing policies, research and development policies, import and export policies, talent policies, intellectual property policies, market application policies and international cooperation policies. [45]. In turn, local governments have provided preferential land use policies for SMIC to support the expansion of its capacity base. In the market, the government through policy guidance, encourage domestic enterprises to use domestic enterprise products, increase the demand of the domestic market. Smic's domestic market revenue grew by 25 percent in 2020, largely thanks to the government's market-guiding policies.

Equipment and technical support

In the face of the US technology blockade, the Chinese government has stepped up support for domestic suppliers of semiconductor equipment and materials to promote domestic alternatives. For example, domestic enterprises such as NDA Optoelectronics have accelerated the R&D and production of key materials such as photoresist to reduce their dependence on US technology[24].

Talent cultivation

The Chinese government to strengthen the cultivation of talent of semiconductor, by setting up a special education funds and scientific research projects, support for colleges and universities and research institutions to cultivate professional talents in the field of semiconductor. Establishing a talent transmission channel for SMIC to help it solve the problem of insufficient technical personnel for independent research and development.

During the period when the US imposed sanctions on SMIC, the response measures taken by SMIC and the comprehensive support provided by the Chinese government both helped SMIC maintain its technological progress and market competitiveness in the difficult situation, and laid a solid manufacturing foundation for the development of China's semiconductor industry.

4.3.7. Impact on SMIC

After studying the case of SMIC, we found that the impact of chip war on SMIC was from different angles.

Negative impact

First, the US sanctions against SMIC during the chip war had a significant impact on the company's technological progress, business and market aspects. The most immediate impact of the U.S. sanctions on SMIC was the disruption of the supply chain. The sanctions have disrupted SMIC's supply chain, limiting its ability to source materials and components from U.S. suppliers. Chip-making equipment and raw material suppliers around the world, including ASML of the Netherlands, have been banned from supplying SMIC [20].

Second, US sanctions have restricted SMIC's access to key technologies and equipment needed for advanced semiconductor manufacturing, resulting in limited production and research capabilities for SMIC. The supply of critical equipment that SMIC originally procured from US suppliers such as Applied Materials, KLA and Lam Research has been affected, resulting in limited access to its production capacity and technology.

Thirdly, Smic has faced challenges in raising capital as the US government restricts American investors from investing in the company. The US sanctions have caused the financial and development status of SMIC to generate and fluctuate, reducing its ability to attract international investors and reducing SMIC's ability to raise funds. However, despite this situation, SMIC still managed to raise a large amount of funds through China's domestic channels, including a US $2.2 billion investment from China IC Industry Investment Fund .

Positive impact

By reviewing the literature and data, we found that the US sanctions have indeed brought many negative impacts to SMIC, but the US sanctions are also driving SMIC's independent R&D process.

First of all, the chip war has intensified the urgency of China's semiconductor industry for independent research and development and innovation. The multiple sanctions imposed by the United States on SMIC have forced SMIC to increase R&D investment, speed up R&D, and commit to realizing the independence of chip production. Smic's breakthrough in 14nm FinFET technology marks an important advance in China's advanced manufacturing process and its efforts in the development of independent technology.

Second, the US export restrictions have forced Chinese chip companies, including SMIC, to question the stability of the supply chain, reassess the security and stability of the US supply chain, and actively seek alternative suppliers in China and other friendly countries to make up for the supply chain disruption caused by the US sanctions. Successfully reducing the Chinese market's dependence on US equipment and materials [26].

In addition to the above impacts, the most important impact of the chip war on SMIC is to build self-developed technology and domestic supply chain. In the face of US sanctions on China's chip industry chain, China's chip industry chain has been fractured and unstable. The Chinese government has actively promoted domestic enterprises to cooperate with SMIC to accelerate the process of autonomy of the whole industry chain, thus promoting the technological level of the whole industry. Under the joint efforts of all these aspects, Huawei Hisilicon, SMIC, Changjiang Storage and other enterprises have built a relatively complete independent chip industry chain system through the coordinated development of design, manufacturing, storage and other links. To some extent, it has escaped the US technology and equipment blockade.

The chip war has had a profound impact on China's chip industry chain, prompting enterprises such as SMIC to step up independent innovation, ensure supply chain security, and speed up technological breakthroughs and market expansion with policy support. Despite many challenges, China's chip industry chain has gradually achieved technological progress, supply chain diversification and overall industrial upgrading in this process, laying a solid foundation for future development.

5. CONCLUSION

The chip war between China and the United States is a major chapter in the geopolitical, technological and economic competition between the two international powers. This study aims to analyze the extensive and profound impact of the chip war on China's chip market, with special attention to the strategic response of Huawei and SMIC. Through the in-depth analysis of the two cases of Huawei and SMIC, it is concluded that in the long run, although the US sanctions have dealt a blow to China's chip market to a certain extent, in general, they have greatly promoted the progress of China's chip self-research and development technology and the self-construction of China's chip supply chain. It makes China gradually get rid of the shackles of the United States and its dependence on the American chip supply chain.

The research of this paper mainly focuses on two cases: Huawei and SMIC. First of all, the United States imposed sanctions on Huawei, including adding Huawei to the entity list, restricting Huawei from purchasing American technologies and products, restricting Huawei from using American chip design software EDA, restricting Huawei's international financial transactions through financial sanctions, and even lobbying Allies to prohibit Huawei from participating in 5G construction and imposing personal sanctions on Huawei's executives. These measures have brought a lot of impact on Huawei. At first, Huawei's supply chain was disrupted, its sales were hit hard, and its earnings suffered severely. However, driven by the tightening policy of the United States, China has accelerated its independent chip research and development through cooperation with the government and other domestic enterprises, invested in domestic technology companies, and established a stable and new supply chain in China. For the long-term development of Huawei, the advantages outweigh the disadvantages.

As the largest and most advanced semiconductor foundry in China, Semiconductor Manufacturing International Corporation (SMIC) is of high value and representative in the research process of this paper [12]. The US sanctions against SMIC have brought great challenges and pressures to SMIC. The US sanctions against SMIC began when it was added to the entity list in 2020 and have been tightened continuously since then, restricting SMIC's access to chip-making equipment, materials and technology. Like Huawei, SMIC is also prohibited from using U.S. electronic design automation (EDA) software. Us investors are also banned from investing in SMIC, which has had an impact on SMIC's stock and financing. In our research, we found that SMIC also chose to increase the degree of independent technology research and development and devote itself to building a domestic supply chain in the face of the US siege. In the face of financial problems, the Chinese government has provided SMIC with a large amount of financial assistance and policy support, paving the way for SMIC to develop chip manufacturing technology. The impact of the United States on SMIC also has the problem of supply chain disruption, which also greatly stimulates SMIC's determination to independently develop technology and equipment.

In the process of studying the business types of Huawei and SMIC, it is found that the business types of Huawei and SMIC are very different. To put it simply, Huawei focuses on the R&D of chip design technology, while SMIC focuses on the R&D of chip manufacturing technology. There are also subtle differences in the impact of the U.S. on Huawei and SMIC, with Huawei facing disruptions in the supply chain for finished chips and SMIC facing disruptions in chip-making equipment and raw materials. Still, the overall impact on both Huawei and SMIC remains a disruption in the chip supply chain. Moreover, both Huawei and SMIC, which have been affected by U.S. sanctions, are committed to developing their own chip technology in the hope of weaning themselves off U.S. dependence.

In general, through the study of the two cases of Huawei and SMIC, we found that although the chip war brought negative impacts to China's chip market, including supply chain disruption and short-term reduction of foreign markets, in the long run, the US sanctions on China's chip market during the chip war stimulated China's independent research and development of chip technology. It has promoted the development of China's chip technology and the process of building its own and

controllable domestic chip supply chain. Therefore, in general, the chip war has played a positive role in promoting China's chip market.

REFERENCES

[1] Nawaz, F., Abu Saleem, K., & Kayani, U. (2024). The made in china 2025 strategy: perceptions and reservations of china's state capitalist economic model.

[2] Gov.cn. (2014). The State Council issued the Outline of the National Integrated Circuit Industry Development Promotion. News _ News _ China government net. Retrieved from https://www.gov.cn/xinwen/2014-06/24/content_2707281.htm [Accessed 9 May 2024].

[3] Bin He. Anqi Bao (2018). Besieged by many countries, Huawei moved whose cheese. https://www.inewsweek.cn/survey/2018-12-14/4586.shtml.

[4] Burkacky, O., Dragon, J. and Lehmann, N. (2022). A trillion-dollar industry. McKinsey & Company.

[5] Capri, A. (2020). Semiconductors at the heart of the US-China tech war.Case Study: A Dark Horse in the Global Smartphone Market: Huawei's Smartphone Strategy. Harvard Business Review Case Studies, 1.

[6] CBC News (2021). The Meng Wanzhou Huawei saga: A timeline. https://www.cbc.ca/news/meng-wanzhou-huawei-kovrig-spavor-1.6188472.

[7] Chacon, M.D.M. and Rajawat, A. (2019). A Case Study on Huawei Technologies. Journal of The Community Development in Asia, 2(3), Pp. 29-36. doi:https://doi.org/10.32535/jcda.v2i3.578.

[8] Chang, R. R. (2006, November). Semiconductor Advanced Technology Development and Challenges in China. In 2006 IEEE Asian Solid-State Circuits Conference (pp. 1-1). IEEE.

[9] Chi, M. (2016). The Overview and the status at 14 nm node and beyond. [online]. IEEE Xplore doi:https://doi.org/10.1109/CSTIC.2016.7464027.)

[10] China Focus. (2021). China Focus | Huawei's Performance Under U.S. Sanctions: Unexpected Results? [online] Available at: https://chinafocus.ucsd.edu/2021/01/22/huaweis-performance-under-u-s-sanctions-unexpected-results/.

[11] Bown, C. P. (2019). The 2018 US-China trade conflict after forty years of special protection. China Economic Journal, 12(2), 109-136.

[12] Ding, X. (2023). Management and here sciences, 6 (1), pp. 494-501. doi:https://doi.org/10.54254/2754-1169/6/2022192.

[13] Ernst, D. (2016). China's New Role in the Semiconductor Industry. [online] Ssrn.com. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2769383.

[14] Fan, P. (2010) From a latecomer to a global telecom giant: the development pathway of Huawei. International Journal of Business and Systems Research, 4(5/6), P. 691. doi:https://doi.org/10.1504/ijbsr.2010.035081.

[15] White House Press Release, Fact Sheet: CHIPS and Science Act Will Lower Costs, Create Jobs, Strengthen Supply Chains, and Counter China (Aug. 9, 2022), at https://www.whitehouse.gov/briefing-room/statements-releases/2022/08/09/fact-sheet-chips-and-science-act-will-lower-costs-create-jobs-strengthen-supply-chains-and-counter-china [https://perma.cc/BM5K-L6NM].

[16] HUAWEI (2019). 2019 Annual Report. [online] huawei. Available at: https://www.huawei.com/en/annual-report/2019.

[17] HUAWEI (2023). 2023 Annual Report. [online] huawei. Available at: https://www.huawei.com/en/annual-report/2023.

[18] Huawei makes breakthroughs in design tools for 14nm chips-media. [online] 24 Mar At: https://www.reuters.com/technology/huawei-makes-breakthrough-design-tools-14nm-chips-media-2023-03-24/.).

[19] Hung, H. C., Chiu, Y. C., & Wu, M. C. (2017). Analysis of competition between IDM and fabless–foundry business models in the semiconductor industry. IEEE Transactions on Semiconductor Manufacturing, 30(3), 254-260.

[20] Jowitt, T. (2024). US Urges Netherlands, Japan To Increase Chip Kit Restrictions For China. [online] Silicon UK. Available at: https://www.silicon.co.uk/cloud/server/us-urges-netherlands-japan-to-increase-chip-kit-restrictions-for-china-568781.).

[21] Lee-Makiyama, H. and Baker, R. (2024). Resilience, Market Conditions or Failed Sanctions? |. [online] ecipe.org. Available at: https://ecipe.org/publications/how-huawei-weathered-the-storm-resilience-market-conditions-or-failed-sanctions/.

[22] Liu, J. C., Mukhopadhyay, S., Kundu, A., Chen, S. H., Wang, H. C., Huang, D. S., ... & He, J. (2020, December). A reliability enhanced 5nm cmos technology featuring 5 th generation finfet with fully-developed euv and high

mobility channel for mobile soc and high performance computing application. In 2020 IEEE International Electron Devices Meeting (IEDM) (pp. 9-2). IEEE.

[23] Liu, Q. (2023). How Huawei surprised the US with a cutting-edge chip made in China. [online] www.ft.com. Available at: https://www.ft.com/content/327414d2-fe13-438e-9767-333cdb94c7e1.

[24] Lv, D. (2020). Smic responds to US 'entity list'. [online] Guancha.cn. https://www.guancha.cn/economy/2020_12_20_575213.shtml.

[25] Sun, H. (2019). US-China tech war: Impacts and prospects. China Quarterly of International Strategic Studies, 5(02), 197-212.

[26] Malkin, A. & He, T., 2024. The geoeconomics of global semiconductor value chains: extraterritoriality and the US-China technology rivalry. Review of International Political Economy, 31(2), pp.674-699.

[27] Mann, T. (2023). Huawei claims to have built its own 14nm chip design suite. [online] Theregister.com. Available at: https://www.theregister.com/2023/03/24/huawei_eda_14nm_chips/.

[28] Mark, J. and Roberts, D.T. (2023). A supply chain under stress. [online] Atlantic Council. Available at: https://www.atlanticcouncil.org/in-depth-research-reports/issue-brief/united-states-china-semiconductor-standoff-a-suppl y-chain-under-stress/.

[29] Ministerial Foreword. (2022). Proposals to issue a designation notice and designated vendor direction for Huawei - government response to consultation. [online] GOV.UK. Available at: https://www.gov.uk/government/publications/targeted-consultations-on-proposed-designated-vendor-direction-and-designatio n-notice/proposals-to-issue-a-designation-notice-and-designated-vendor-direction-for-huawei-government-response-to-consu ltation

[30] Office of Public Affairs (2020). Commerce Adds Chinese SMIC to the Entity List, Restricting Access to Key Enabling U.S. Technology. [online] U.S. Department of Commerce. Available at: https://2017-2021.commerce.gov/news/press-releases/2020/12/commerce-adds-chinas-smic-entity-list-restricting-access-key-enabling.html.)

[31] Nat'l Security Comm'n on Artificial Intelligence. (2021). Final Report 214. Retrieved from https://www.nscai.gov/wp-content/uploads/2021/03/Full-Report-Digital-1.pdf [https://perma.cc/M8TT-QNC7].

[32] U.S. Dep't of Commerce Press Release. (2022). Commerce Implements New Export Controls on Advanced Computing and Semiconductor Manufacturing Items to the People's Republic of China (PRC). Retrieved from https://www.bis.doc.gov/index.php/documents/about-bis/newsroom/press-releases/3158-2022-10-07-bis-press-release-advanced-computing-and-semiconductor-manufacturing-controls-final/file [https://perma.cc/F4M3-6GCC].

[33] Research and development strategies to fast advance China's semiconductor industry. [online] doi:https://doi.org/10.1109/iwjt.2009.5166204.

[34] Rho, S., Lee, K. and Kim, S.H. (2015). Limited Catch-up in China's Semiconductor Industry: A Sectoral Innovation System Perspective. Millennial Asia, 6(2), Pp. 147-175.doi:https://doi.org/10.1177/0976399615590514.

[35] Ryan, M. and Burman, S. (2024). The United States–China 'tech war': Decoupling and the case of Huawei. Global Policy. doi:https://doi.org/10.1111/1758-5899.13352.

[36] Shivakumar, S., Wessner, C. and Howell, T. (2024). Export Controls on U.S. Chip Technology to China. www.csis.org. [online] Available at: https://www.csis.org/analysis/balancing-ledger-export-controls-us-chip-technology-china.

[37] Shrivastava, M. (2024) How Is Huawei Growing, Despite Heavy US Sanctions? [online] thediplomat.com. Available at: https://thediplomat.com/2024/07/how-is-huawei-growing-despite-heavy-us-sanctions/.

[38] Sina.com.cn. (2007). H3C bid farewell to Huawei and announced its strategic development route for the first time. [online] Available at: http://tech.sina.com.cn/t/2007-04-28/05241488574.shtml.

[39] SMIC (2019). 2019 Annual Report. [online] smic. Available at: https://www.smics.com/uploads/e00981.pdf

[40] SMIC (2022). 2022 Annual Report. [online] smic. Available at: https://www.smics.com/uploads/e00981.pdf

[41] "US government adds Chinese chipmaker SMIC to Entity List." China Telecom, vol. 27, no. 12, Dec. 2020, pp. 2+. Gale Academic OneFile. Retrieved from link.gale.com/apps/doc/A654619343/AONE?u=glasuni&sid=summon&xid=0d263eb8 [Accessed 11 May 2024].

[42] Statista (n.d.). Global mobile phone market share by vendor 2022. [online] Statista. Available at: https://www.statista.com/statistics/632168/global-mobile-phone-market-share-by-vendor/.

[43] "US slaps trade restrictions on China's top chipmaker." Engadget HD, 26 Sept. 2020, p. NA. Gale Academic OneFile, link.gale.com/apps/doc/A636572203/AONE?u=glasuni&sid=bookmark-AONE&xid=e3589ac8. Accessed 9 May 2024.

[44] Sun, L. (2018). Beijing: China Friendship Publishing Company, p.

[45] The State Council of China (2020) promote the High-quality Development of Integrated Circuit Industry and software industry in the New Period. [online] www.gov.cn. Available at: https://www.gov.cn/zhengce/content/2020-08/04/content_5532370.htm.

[46] TSMC ends Huawei orders: report. [online] Taipeitimes.com. Available at: https://www.taipeitimes.com/News/biz/archives/2020/05/19/2003736638.

[47] Peters, M. A. (2023). Semiconductors, geopolitics and technological rivalry: the US CHIPS & Science Act, 2022. Educational Philosophy and Theory, 55(14), 1642-1646.

[48] Voice of America (2024). The US government has tightened its grip on SMIC and suspended more US export licenses. [online] Voice of America. Available at: https://www.voachinese.com/a/us-targets-china-s-top-chipmaking-plant-after-huawei-mate-60-pro-sources-say-20240221/74965 14.html.

[49] Wang, L. (2022, July). China's Huawei in the US-China Trade War in the communications sector game. In 2022 2nd International Conference on Enterprise Management and Economic Development (ICEMED 2022) (pp. 485-497). Atlantis Press.

[50] Weissberger, A. (2024). Huawei has come 'roaring back,' due to massive China government support and policies – Technology Blog. [online] Comsoc.org. Available at: https://techblog.comsoc.org/2024/07/30/despite-u-s-sanctions-huawei-has-come-roaring-back-due-to-massive-china-governmen t-support-and-policies/.

[51] www.smics.com. (2005). SMIC entered into an agreement with TSMC. [online] Available at: https://www.smics.com/site/news_read/2433.

[52] www.smics.com. (2009).. SMIC reached all litigation settlements with TSMC with no expected disruption to customers. [online] Available at: https://www.smics.com/site/news_read/2511.

[53] Liu, B. (2024). National Integrated Circuit Industry Investment Fund and enterprise technological innovation: evidence from China. International Journal of Economic Policy Studies, 18(1), 63-84.

[54] www.smics.com. (2015). SMIC's 28nm chip loaded into mainstream smartphones opens a new era of advanced chip manufacturing in China. [online] Available at: https://www.smics.com/site/news_read/2706.

[55] www.smics.com. (2020). SMIC (688981) was successfully listed on the Science and Technology Innovation Board of the Shanghai Stock Exchange today. [online] Available at: https://www.smics.com/site/news_read/3477.

[56] Iyengar, R. (2022). Biden Short-Circuits China. Foreign Policy. Retrieved from https://foreignpolicy.com/2022/10/28/biden-china-semiconductors-chips.

[57] Fuller, D. B. (2021). China's counter-strategy to American export controls in integrated circuits. China Leadership Monitor, (67).

[58] Moore, S. K. (2019). Another step toward the end of Moore's law: Samsung and TSMC move to 5-nanometer manufacturing-[News]. IEEE Spectrum, 56(6), 9-10.

[59] Rosales, O., & Kuwayama, M. (2007). Latin America meets China and India: prospects and challenges for trade and investment. CEPAL Review, 2007(93), 81-103.

[60] Ma, M. (2024). A Study on the Game Strategy of Chip Price Behavior at the Background of the US-China Trade War. In SHS Web of Conferences (Vol. 188, p. 03012). EDP Sciences.

[61] Mascitelli, B., & Chung, M. (2019). Hue and cry over Huawei: Cold war tensions, security threats or anti-competitive behaviour?. Research in Globalization, 1, 100002.

[62] Xia, J., Cheng, C., Zhou, X., Hu, Y. & Chun, P., 2021. Kunpeng 920: The first 7-nm chiplet-based 64-core arm soc for cloud services. IEEE Micro, 41(5), pp.67-75.

[63] Zhang, X. (2023). How Huawei Survives after US Sanctions. [online] EqualOcean. https://equalocean.com/analysis/2023082920115.

[64] Barker, B.J.P. and Rhee, S.-M. (2022). US Department of Commerce's Bureau of Industry & Security (BIS) Implements Additional Controls on Semiconductor and Gas Turbine Engine Technologies | Advisories | Arnold & Porter. [online] Arnold & Porter. Available at: https://www.arnoldporter.com/en/perspectives/advisories/2022/08/bis-implements-additional-controls?utm_source=mondaq&utm_medium=syndication&utm_content=contentmaxviews&utm_campaign .

[65] Zhu, H. and Jones, M. (2014). Huawei: An Exemplar for Organizational Change in a Modern Environment.