

Trend Evaluation of Venture Capital Investment in Mainland China's Semiconductor Industry

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Abstract: As chips become more prevalent in daily life, many countries understand that in order to become self-sufficient, they must build their own semiconductor supply chains. China, a country that has stalled behind in developing chips, is also aware of this. To this end, the government started vigorously promoting investments in semiconductors, turning them into popular business opportunities. Venture capitalists (VC), who typically prefer high risks but greater returns, are responsible for the greatest growth. They think that even though politics and technology have placed restrictions on the industry, there is still room for growth in the semiconductor market. This paper breaks down the recent trends in the semiconductor industry of mainland China, with a particular focus on sensitive points such as political treaties and social phenomena. According to results, the mainland semiconductor industry merits attention and has a promising future. Venture capitalists should look for companies with the following characteristics: highly educated and experienced employees, the ability to design chips independently, and a stable supply chain.

Keywords: semiconductor, Chinese chips, venture capital, PEST model, POCD framework

1. Introduction

In recent years, semiconductor companies have enjoyed rapid growth and share prices, and such firms are in the strategic opportunity period of outstanding achievements [1]. However, due to the complex market environment, the industry faces numerous risks and challenges. Politically, China's semiconductor industry is constantly under attack from other countries, with wars and various policies posing threats to the industry. In the trade war between China and the United States (U.S.), the U.S. repeatedly imposed tariffs, blocking the supply chain. The Chips Act 2022, introduced in July, promised to fund supplier research but prohibits those companies which receive subsidies from expanding chip production in China or any other "specified country that poses a national security threat to the United States" for ten years. Such a targeted act has further curbed Chinese semiconductors' growth [2]. Technically, the lack of connectivity with the West has kept China behind other countries. The semiconductor is a technological and talent-intensive industry that

requires high-end and often highly specialized R&D expertise. Due to the shortage of professionals, it is not optimistic for China to have a strong presence in chip design.

Nevertheless, the semiconductor industry continues to be a popular business, attracting millions of startups. Its boom is evidenced by the integrated circuit (IC) industry. In recent years, the financing volume of IC in mainland China has been on a substantial rise: in 2021, there were 641 investment rounds with 18 billion USD; while as of August 2022, the number has reached 421 rounds with nearly 10 billion USD, which is expected to reach another record high by the end of the year [3]. According to Professor Wei Shaojun, the number of mainland chip design companies would reach 2,810 by the end of 2021, up 26.7% yearly [4]. The huge potential is primarily thanks to the consumer market: China remains by far the largest semiconductor consumer, accounting for nearly 60% of the global market share. Even the United States is in second place, with about 12 percent [5]. The enormous consumption share and the lack of technology in production have led to China's dependence on chip imports. As a result, achieving domestic supply chain perfection has become the first major problem for China. Hence, the Chinese government fully began to support the semiconductor industry's development, proposing large fund programs almost every year, thus triggering a full-fledged VC focus on this industry. With the growing follow-the-leader financing, Venture Capitalists require an objective reassessment of the current situation to test whether they have lost themselves in the oasis of the semiconductor boom and valuation inflation.

This paper will utilize the PEST model to discuss the industry prospect from four aspects: Politics, Economics, Society, and Technology. Furthermore, an exemplary Chinese semiconductor startup—SD Technology—will be evaluated in a POCD framework, demonstrating the characteristics of a VC-worthy firm. Through this research, VC investors will refine their perceptions of this high-return industry to find the most rewarding deal in the wave of technology firms.

2. Factors That Influence the Current Situation

2.1. Political Issues

The performance of semiconductors in the high technology industry determines the level and strength of a country and its interest in it. Thus it has evolved into a political weapon over time, with U.S. restrictions being the biggest contributing factor. Given the competition between the U.S. and China, the U.S. government has expressed its commitment to fostering and strengthening the semiconductor industry, with plans to enhance not only the attraction of production bases but also the development of technology. In 2018, the President of the United States announced to direct the Office of the United States Trade Representative (USTR) to impose tariffs on imports from China under Section 301 of the (Trade Act of 1974) to “punish China for theft of U.S. intellectual property and trade secrets” [6]. In addition, the introduction of the “Chips Act” has greatly subsidized the production industry and blocked China's development. These actions completely cut off any possibility of interaction between the two countries on semiconductors. The ripple effect brought by the U.S. is massive as well. On August 2, 2022, U.S. House Speaker Pelosi made a visit to Taiwan, which infuriated China. With a potential civil war, China sent numerous troops to be stationed on the Taiwan-Mainland border for an extended period. As a long-time semiconductor supplier to the mainland, Taiwan will likely stop doing business with it in the future, which will significantly impact the Chinese supply chain. The present political situation is forcing China to act immediately, whether it be internal or external.

2.2. Economic Issues

From 2008 to 2021, China's semiconductor sales rose significantly in all sectors, including a 22.8-fold increase in the equipment field, a 13.2-fold increase in the design field, and an 8.1-fold rise in the manufacturing field [7]. And behind these increases stand three points: national funding support, tariff preferences, and the rise of the electronics. In terms of funding, China has established the National Semiconductor Industry Fund, which raised a total of about 50 billion in two phases in 2014 and 2019, providing sufficient financial support for the overall development. In addition to funding, China tried to benefit the midstream companies such as raw material suppliers on the tax front. According to the document "Notice of the National Development and Reform Commission of the Ministry of Finance, the Ministry of Industry and Information Technology, the General Administration of Customs, the General Administration of Taxation on the management of import tax policies to support the development of integrated circuit industry and software industry" issued by the Ministry of Finance, the General Administration of Customs and five other ministries and commissions, semiconductor companies are exempt from tariffs on the import of equipment and software for their use [8]. The elimination of import tariffs facilitates the customs pass of raw materials. It also reduces the cost of the semiconductor industry simultaneously, solving the problem of over-consumption of upstream companies and downstream companies. This shows that the Chinese government attaches great importance to the reduction of capital. Even with the government's efforts, there is still a conundrum: the extreme imbalance between supply and demand. This imbalance is mainly because downstream companies are far outpacing upstream and midstream development. For example, China's electronics, as one of the significant downstream, has stayed at the top in the global market during the past few years. Besides, China owns the largest consumer market for electronics, with 1.02 billion internet users, but most semiconductor companies can still not catch up with the gap [9]. If the development of the semiconductor industry and electronics industries continue to polarize with each other, then the disparity will only worsen, so China is trying to enhance the supply of semiconductors at all costs. From these three observations, support at the national level determines the prospects for economic development, and China is performing excellently in this regard.

2.3. Societal Issues

In China, the development of the semiconductor industry relies on several social trends. First, within the last decade, many families have chosen to send their children abroad to pursue education. Despite the trend slowing down after 2019 due to the epidemic, China is still the most significant origin of international students worldwide. The increasing number of international talents has enabled many Chinese to learn western production technology, contributing immensely to the growth of China's semiconductor industry. Even more, fortunately, Covid-19 has increased the willingness of those students to go home. According to the Survey Report on 2020 China Returnee Employment and Entrepreneurship released by Zhaopin in January 2021, overseas talents are more willing to return to China in 2020, and the return of the overseas is unstoppable, as "better control of domestic epidemic" is the first reason for international students to choose to return to China (56.8%) [10]. To keep this trend growing, the Ministry of Education and Beijing Municipality officially signed the Cooperation Framework Agreement of Ministry and Municipality Jointly Building Demonstration Zone for Returned Overseas Talents Service on August 26 at the opening ceremony of the HICOOL2022 Global Entrepreneur Summit in Beijing. At the ceremony, Minister Huai Jinpeng stated that the country had established a new era of "supporting study abroad, encouraging return to China, freedom

to come and go, and play a role" [11]. From the above, the current years are the most talented people returning: the willingness of spending time with their families has risen and the support of the country are reinforced. In this new era, there will be great potential for human resources in the semiconductor industry.

2.4. Technological Issues

The biggest problem facing China's semiconductor industry now is the lack of technology. A key factor is timing: semiconductors were invented in the United States in the 1700s, and the Japanese semiconductor industry has been booming since the 1980s. By contrast, it was only in 1988 that China noticed this production and started to develop it. In addition, China has only become one of the largest economies in the last decade, and they had to prioritize manufacturing due to the most considerable advantage. And the gap widened further as it dragged on. After missing the timing, China's development is even worse than South Korea which started much later in the semiconductor. According to Sakamoto Yukio, president of Micro Memory Japan, Changxin Memory Technology, which is at the top level in China in the DRAM field, is about 4 generations behind Samsung. In the field of NAND flash memory, it is said that China's top Yangtze Memory Technology (YMTC) has too few manufacturers to reach the level of competitiveness. In the field of logic chips for computing, even China's top-tier Semiconductor Manufacturing International Corporation, the thinnest circuit line width of its products is only 14 nanometers, which was a technology 7 or 8 years ago. The world's top TSMC is developing 2nm products, and the gap is still ongoing [12]. The lack of equipment also leads to backwardness in science and technology. Shortage of necessary production auxiliary equipment such as lithography machines and photoresists further reduces China's competitiveness. Obviously, the major barrier to investment right now is technology. Since the semiconductor industry has a long supply chain, startups that are not competitive risk being eliminated by the industry giants, wasting all of the VC capital. However, given how quickly and significantly China has developed over the past ten years, the timing and equipment problems will eventually be resolved.

3. POCD Analysis of a Potential Investment for Venture Capitalists

The previous section analyzed the current situation of the semiconductor industry in China; this section will focus on selecting a worthy semiconductor company specifically for venture investors using a POCD framework (People, Opportunity, Context and Deal). According to Figure 1, 67.2% of the investments are focused on the design sector, showing a general trend for venture capitalists. This paper will explore the SD Technology, a chip design startup, as the primary target for analysis.

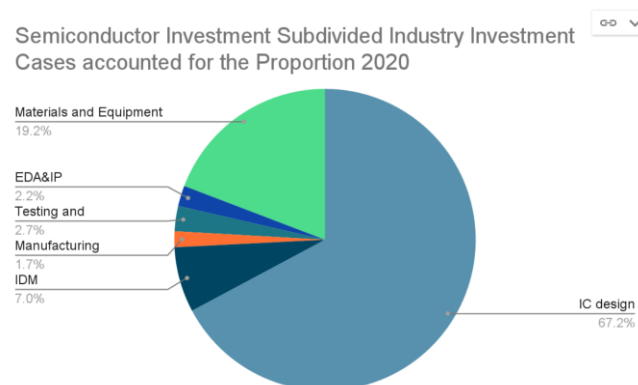


Figure 1: Semiconductor investments breakdown share 2020 [13].

3.1. Company Overview

SD Technology was established in 2018 and is headquartered in Nanjing, China. It has design and R&D centers in Shanghai, Beijing and offices in Shenzhen. SD Technology focuses on automotive intelligence and aims to serve the global automotive industry with high-performance and highly reliable chips. At present, 9 series of high-performance SoCs have been released for the intelligent cockpit, autonomous driving, and central gateway, and the lower-level domain control chip of the vehicle with a higher functional safety level has been completed in the same period. With foreseen potential, SD Technology has built a rich industrial ecology with more than 70 partners [14].

3.2. People

SD Technology's CEO and Chairman are the key personnel. The chairman plays a crucial role in product positioning and research. He has over 20 years of experience in product, market and sales in the automotive electronics and semiconductor industries, responsible for the Greater China Automotive Division in Delphi Automotive Electronics, Philips Semiconductors, Infineon, Freescale and NXP. With his experience, he led the team to invest in the research of safer and more reliable automotive chips, provided intelligent automotive core chip products and system solutions for the industry, positioned the product market with strategic thinking, and made an entire five-year plan for each product to be launched [15]. The company's current CEO studied in the Department of Radio Engineering of Southeast University as an undergraduate. She entered the University of Wisconsin-Madison for further studies and received a master's degree. The CEO has worked in Silicon Valley in the United States and successively joined Neomagic, Catamaran and Serverengines, focusing on the research and development of optical fibre communication chips. She has also participated in related work in integrated circuits' R&D and production stages. Later, she joined Freescale in 2011 and led the team to develop products with the largest market share among the global automotive-grade processors. In 2018, when the rise of new car-making forces, the two business partners, who have more than 20 years of experience in the automotive semiconductor industry and have known each other for 10 years, saw the impact of intelligent domestic networking and autonomous driving on chip computing. In response to the commercial needs of the power, the two established SD Technology [16].

3.3. Opportunity

Since the outbreak of Covid-19, there has been a significant shortage of automotive chips in mainland China due to limitations in shipping convenience. According to a study by JP Morgan, in the second half of 2021 alone, 2.6 to 3.6 million vehicles were affected, reducing production by more than 10 million vehicles for the year [17]. In this situation, improving the supply chain in China and expanding the production volume became urgent. SD Technology has vast potential in this area. In one way, they have achieved a fully independent design of core IP and have over 100 intellectual property rights within three years, proving that they do not need to rely on a foreign power. The other way, because SD Technology is the only automotive chip company in China that can provide all major chips on automotive electronic and electrical architecture, the "integrated" strategy creates strong linkage and high compatibility among various products [18]. Both points highlight an industry-wide trend: chip companies and related enterprises are strengthening internal communication. Due to the Western crackdown and the pandemic, more firms realize that relying on imports is unstable if they want to get a timely and reasonably priced supply of chip sources, and the only solution is to establish in-depth communication with domestic chip suppliers. To improve interaction and keep

track of production capacity, some businesses established a dedicated docking chip department, and some even began to look into the design of alternative solutions starting at the chip level [19]. All these signs signal that the prospect of domestic semiconductor firms is promising. However, the domestic supply chain could be volatile too. While other nations attempt to lessen the effects of Covid by opening their borders, China has remained circumspect, maintaining its quarantine and Covid test system, which creates tougher shipments. With the two-sided impact, internal communication, while necessary, will only be able to proceed successfully once the covid factor is removed. But all in all, the epidemic's effect will only fade away over time, and the overall development of SD Technology is still worth investment.

3.4. Context

The context is described exhaustively in the PEST analysis, but a summarization will be shown here to help in comprehension. The semiconductor industry is currently experiencing the worst shortage in twenty years. Semiconductors have developed into an essential strategic material in both the military and civilian sectors, and they now represent the strategic commanding heights from which nations compete for development. As a result of U.S. sanctions against China, the Chinese government has also intensified its focus on semiconductor development. However, due to their extremely high levels of market capital, scarcity of human resources, and lagging technological levels, other countries have developed years ahead of China. The major impact of government subsidies is that they encourage many people to enter the market, raising competition. For instance, other setups like "LinearX" and "Enjoy Move" can take its place.

3.5. Deal

Table 1: SD technology's financial history [20].

Announced Date	Transaction Name	Money Raised	Lead Investors
26-Apr-22	Series B+	Unknown	W&W Fund Management
25-Jul-21	Series B	CN ¥ 1B	Pro-Capital, V Fund Management, CTC Capital
27-Sep-20	Series A	CN ¥ 500M	CTC Capital, Matrix Management, Lenovo Appliance Defender
19-May-19	Series Pre-A	Unknown	Matrix Management, Vertex Ventures China, Lenovo Appliance Defender
18-Sep-18	Seed Round	CN ¥ 100M	Walden International, Lenovo Appliance Defender, Sequoia Capital China

In the Deal part, due to the lack of financial statements for startups, this paper will concentrate on SD Technology's financial history by analyzing the amount raised and lead investors. Since the time it was founded in 2018, it has continued to raise money each year. By September 2022, it had raised \$227.7 M (based on the number of publicly known rounds).

In particular, the seed round amounted to CN\$100M, which is far more than the common size. According to Figure.2, 57% of Chinese unicorns lacked an angel or seed round, and their first round of funding came in Series A. The remaining 43%, however, tend to show a high level of attractiveness in terms of idea, prototype, business model, etc., which makes investors willing to take a huge risk to invest their capital. SD Technology, which received a huge seed round of investment, certainly shows

great potential. In Series A and Series B, SD Technology raised CN\$500M and CN¥ 1B respectively; the amount quantity and continuity also proved the vision of the early seed round investors. SD Technology's lead investors include Sequoia Capital China, Lenovo Appliance Defender, Matrix Management, CTC Capital, ProCapital, V Fund Management, and Vertex Venture China. Of these, Sequoia and Matrix are ranked among the top 10 unicorn investors in China, while the former is even the top 1 in the world, with 234 unicorns as of 2022 [22]. Despite the lack of financial reports, the prediction is that investing in SD Technology is a good choice given the current funding and reliable follow-on VCs.

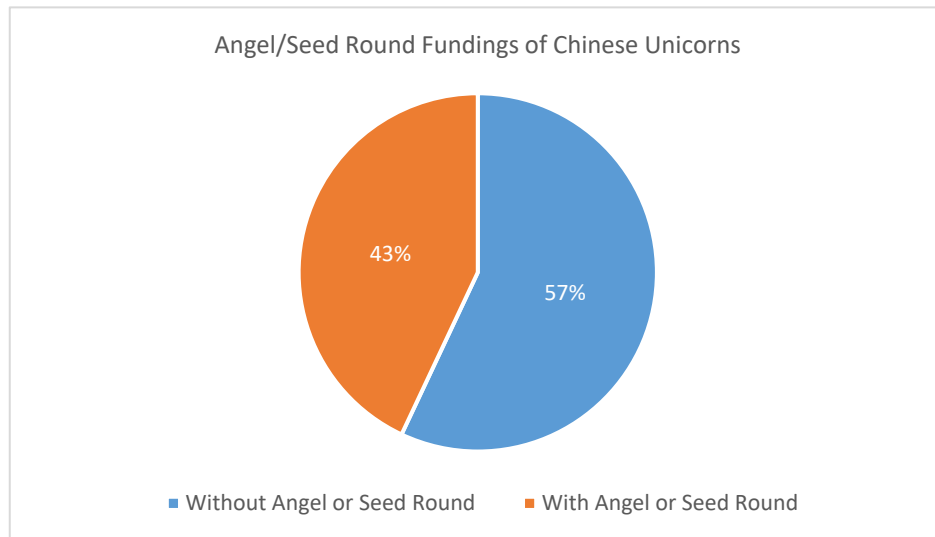


Figure 2: Angel / Seed round fundings of Chinese unicorns [21].

4. Conclusion

This paper examines the growth of the semiconductor sector and the potential of a representative unicorn company in mainland China using the PEST model and POCD framework. From a macro perspective, the entire industry is favourably trending. Although there is technical and political pressure, such pressure is transformed into motivation for further efforts. China's sufficient funding and huge consumer market also determine the future of the industry. Furthermore, an up-and-coming unicorn business in Mainland China named SD Technology has demonstrated good standards from a micro perspective. Its position in the market—making semiconductors for cars—along with its workforce, rate of expansion, and funding all point to a semiconductor company with limitless potential.

The main contribution of this paper is to include a summary of the challenges facing the Chinese semiconductor market, a justification for investing in Chinese semiconductors, and an illustration of a creditable semiconductor company for venture capitalists who are still keeping an eye on the market. This study will help more semiconductor workers comprehend the industry's advantages and disadvantages, as well as help venture capitalists, gain insights into their investments.

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