



Huawei's Competitiveness in Operations and Supply Chain Management

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Abstract. In this paper, it manifests the issue and conflict exist on Huawei company's development. During the company's first several years, its business model revolved around reselling private branch exchange switches while reverse-engineering imported switches and researching its technologies. Its first breakthrough was developing the C&C08 program-controlled switch, which was the most powerful switch available in China. Huawei has since expanded to become an international company, which has led to friction with the United States. In the past decade or so, the United States has sanctioned Huawei multiple times, not only stunting and its capability to grow in the markets of the United States, but also restrict its own chip developing. However, Huawei now is going to develop a new way for surviving.

Keywords: Huawei, United States' Sanctions, 5Gchips

1 Introduction

First of all, under the business sanctions from U.S. that chips' company are not going to cooperate with China Huawei. which also indicates TSMC (Taiwan Semiconductor Manufacturing Company), and Huawei were forced to terminate their cooperation. This essentially slowed down the future market and research and development of Huawei 5G cell phones. Secondly, Huawei's research on development of 5G chips was launched after the event of a chip cut-off in the United States. Nevertheless, it still cannot solve the current shortage of 5G chips on China's phone market. Meanwhile, because of the 5G chip shortage situation in Huawei, Huawei has to reduce the mass production of cell phones from 13 percent of global cell phone sales and share in 2020 to 6 percent of international cell phone sales in 2021.

2 Research Review

The U.S. sanctions have posed a significant threat and pressure on its current supply chain regarding Huawei's mobile phone business. In the past few years, the U.S. has set up several policies to limit the growth of Huawei company. "On May 15, 2019, the U.S. first round of sanctions is made. "To be specific, any electronic device made by 'foreign adversary' is forbidden arise from a security concern of domestic communication systems [1]." After, the next round arrives at the same time next year." According to A.P., the U.S. has posed further sanctions against Huawei regarding its supply chain. A new constraint, formulated by the Commerce Department, requires foreign semiconductor markers which use technology from the U.S. to stop delivering goods and services to Huawei, especially their chips blueprints. They are not allowed to cooperate with Huawei if they do not have a license given by the U.S. authority [2]." Finally, the U.S. gave Huawei a strong shock on September 15, 2020. "It is reported that chips factories from U.S. or abroad that contain U.S. technology can no longer cooperate with Huawei in chips transportation and manufacture [3]. Therefore, Huawei's current supply chain is under attack and needs to find a way out. "In the latest news conference of Huawei, Guo Ping, the rotating chairman, implied that KIRIN chips are likely to be the final series of Huawei [4].

"According to a recent industry report, the market share of Huawei's new models, after sanctions, declined significantly in 2021, while Vivo and Oppo, which released more 5G new series, shows an improvement in sales. [5]." In other words, there is a decline in consumers who still choose Huawei mobile phones when they purchase a new mobile phone. Multiple rounds of U.S. sanctions have caused Huawei to encounter many problems in its business. Meanwhile, "Counterpoints posts its 2021 report on smartphone sales in China indicating that Huawei's market share in China falls to 10 percent from 31 percent in 2020. [6]. However, how does the U.S. sanction affect Huawei's mobile phone business in global market? The answer will be discussed in the following paragraph. In 2019, Huawei's 5G chip was cut-off by the United States, with this case, the resulting in Huawei's phone is not being able to use 5G internet in its new generation of phone. Moreover, the second round of sanctions by the U.S. government, is directly caused Huawei chips manufacture stopped after September 15. In doing so, Huawei does not fully prepare from cutting off 5G chips. And Huawei's upcoming flagship Mate 40 will be made with the 5nm Kirin 9000 chip. Still, it will be the last generation of chips that TSMC provided chips for Huawei's phone unless the U.S. government withdraw the sanctions. Although Kirin chips have made many technological breakthroughs after U.S. sanction. The process of Chinese domestic chip makers is still behind the global industry's mainstream in terms of chip manufacturing. first of all. Its work's efficiency cannot meet the demand of Huawei's Phone in the market. second of all, Huawei's phone cannot work as quick as high-end Kirin chips developed based on the 5nm process.

As we talked above, in the last year, the first around of U.S. sanctions did not affect TSMC, which is where Huawei's Kirin chips manufactured. Still, the second around of sanctions in May this year finally forced TSMC to "cut off supply" to Huawei and made the Kirin 9000 an extinction without a manufacturing plant, as well as Google's

cooperation with Huawei. Google was forced to stop providing technological services for Huawei's phones, which already made Huawei's new products negatively consequences in global markets before the sanctions, was not allow to use 5G chips. Huawei, which just in the top list of the global smartphone shipment in the second quarter of this year. However, the U.S. government's second round of Huawei sanctions was issued on May 15, by giving Huawei a four-month buffer to take effect on September 15. In other words, TSMC will no longer accept new orders from Huawei after May 15 and will no longer supply Huawei after September 15. During these four months, Huawei has already started preparations for the consequence, and the patent licensing agreement with Qualcomm is one of the critical steps. Then Huawei will use the four months for a transition. In the change simultaneously, Huawei is also developing its own 5G R.F. chip. Huawei claims in 2023, Huawei will establish its own 5G chip to completely. Huawei will reduce the negatively impacts as soon as possible.

But a cell phone on the chip up to hundreds, even powerful as Huawei, cannot all achieve independent production, and this time the constraint of Huawei 5G function is the radio frequency chip. R.F. chip belongs to an analog chip, also known as the jewel in the crown of analog chips. Its function is mainly to convert the wireless communication baseband signal into a radio frequency signal to transmit out; simultaneously, the received radio frequency signal into a digital signal and handed over to the baseband processing. Although it is less complicated than CPU in terms of function and design, it is still significant in the chip field. In the R.F. transceiver and power amplifier two aspects, Huawei has achieved localization, but in the R.F. front-end still has to rely on Sky works and Qorvo, other manufacturers. 4G R.F. chip because the patent has passed the protection period, so has achieved a breakthrough; but 5G because just appeared not long ago, so there is a lot of patent protection. In 2021, the total import of chips alone will be more than \$ 439.7 billion, accounting for more than 25.3 percent of the total imports of 17.37 trillion, making it the number one imported product. At the same time, Huawei chip function 's self-sufficiency rate is only 26.6 percent. But the problem of chips is becoming more and more difficult.

We mentioned that the decline in sales of Huawei's mobile phone business is due to the sanctions imposed by the United States. How Huawei deals with this problem and its plans for this crisis become more critical. Huawei should consider how to survive under the pressure of manufacturing their own 5G chips. As Chairman of Huawei Guo Ping Presented in the speech for Huawei, Survival in these circumstances is the first thing they should do, and they need to figure out how to achieve it. In a speech a week after the U.S. imposed sanctions, those were his idea. Here are Huawei's solutions to U.S. sanctions.

Firstly, the Guardian news pointed out that Catherine Chen, a member of Huawei's board of directors, said that although the mobile phone industry has been subject to U.S. sanctions, Huawei still has ways to discover new fields, such as artificial intelligence and electric vehicles, while bypassing U.S. patents. In other words, Huawei needs research and development in other areas to help it face the risk of bankruptcy in an emergency, which means we may see other Huawei products. At the same time, Huawei has not given up on continuing research and development in different areas to share the pressure in the mobile space. As Chen said, they have strong confidence in Huawei's

R&D investment. In her words, "Our R&D investment this year will remain around \$20bn (£14.5bn). According to a report from Europe, Huawei has ranked as one of the top R&D spenders for ten consecutive years. We also rank among the top companies regarding patent applications [7]." In research and development, Huawei is about to do a big project on electric cars and operating systems. According to Bloomberg, "Huawei Technologies Co. will invest \$1 billion on researching self-driving and electric-car technologies, accelerating plans to compete with Tesla Inc. and Xiaomi Corp. in the world's biggest vehicle arena [8]." It's a sign that Huawei is taking the electric car market seriously, its shift in corporate focus on making and develop its electric car. business to keep the rest of its business running.

Not only the E.V., but Huawei has also responded to U.S. sanctions by developing its operating system, called Harmony OS. According to the official website, Harmony OS, it is an Android-like operating system that Huawei began developing in 2012. Huawei's goal is to turn Harmony into an eco-connected operating system; for example, Harmony OS phones can connect to smart household appliances and the Huawei cars we mentioned and use the phone to control the air conditioning lights. According to a Huawei news conference, by the end of 2021, The Harmony system had been installed on 220 million devices. At the same time, Huawei released its first electric vehicle, the M5, equipped with Huawei's Harmony operating system. Huawei fulfilled its plan in 2019, but the quality needs to acquire market approbation. However, from Jose Pontes' data, as of the first quarter of 2022, Harmony OS has received a good response, but Huawei AITO M5 only ranked below the top 20 in China's electric vehicle rankings in the first quarter of 2022.

The Guardian news mentioned that the reason for the sanctions against Huawei is that the administration of Donald Trump has imposed sanctions on the mobile phone and telecommunications industries for fear of spying, so devices for manufacturing and technologies related to U.S. patents cannot be used. Today, it has been more than two years since U.S. sanctions were imposed, and Huawei's chip industry has been most affected during that time, which has been stagnant. To solve the problem caused by the sanctions from the root, Huawei must develop its own supply chain. That is, they need to possess a complete and independent industrial chain that is not affected by U.S. patents. In March 2022, Huawei already has new developments and ideas in the mobile chip industry. On the supply chain, Amy Sarkar mentioned that Huawei has teamed up with SMIC, the largest wafer fab and contract chipmaker in mainland China. Although the technology lags behind TSMC by about five years, it is now the only chipmaker that can use it. Huawei is also working through TSMC's supply chain to improve its own supply chain and expand its own chip manufacturing capabilities. According to Huawei Central and UDN, Huawei will invest more than \$10 billion to build fabs to improve its supply chain.

For the manufacturing of the chips, Huawei had to accept SMIC, a Chinese chipmaker, five years behind the other chipmakers, but Huawei provided a solution, which, according to Ping, was confirmed using something called Chip Stacking Technology. Chip Stacking Technology is a method of stacking chips. In the case of backward technology, the same performance must be achieved by using more area and stacking the chips. Another way to explain it is that on the same size chip, the technology is not as

good as cash but can achieve the same performance by increasing the number and making them work together to keep the product competitive. But it's just a theory at the moment, Huawei has not presented a substantive report or product, and the advantages and disadvantages of the technology have not been fully demonstrated.

3 Analysis

Due to the strict policies, U.S. companies cannot sell goods and services to Huawei. As a result, Huawei will fail to procure all the raw materials it needs and cause further consequences in its manufacture. There is a reflection in its new smartphone's series; according to CNBC, "Huawei on Thursday launched its new P50 and P50 Pro smartphones without support for super-fast 5G internet [9]." Each electron device combines many materials and parts such as batteries, screens, motherboards, and chips. Theoretically, the phone cannot work if any of these components are in shortage. However, some elements in smartphones, like metals, are an industry with a relatively low barrier to entry, which means their firms around the globe have the same ability to get into the industry and become a supplier without technology barriers. In this case, Huawei can still choose goods and services from other suppliers if they only lack 'low-end' components. But the situation is different here; the chips industry, the sector that determines the overall competitiveness of the phone, has high barriers to entry since it requires machines that are extremely precise and cannot be produced without years of work and efforts by professional scientists, physicists, and mathematician. "Solving the chip problem is a complicated and long process that requires patience. In the future, our chip solution may adopt a multi-core structure to improve the performance. We are delighted to see more companies join the market [10]." said Guo Ping, Chairman of Huawei. Once its influential chip makers stop selling chips to him, Huawei has no other channels to buy the high-performance chips it needs. Huawei's lack of raw material procurement made it impossible to achieve an average amount of shipments in the production stage. As a result, overall mobile phone shipments declined. Huawei Chairman Guo Ping also said at the annual Huawei Connect event in Shanghai that its supply chain was "under attack." The production structure of Huawei's internal products is complex, and the products are highly related to each other.

Also, considering the business model of Huawei, U.S. sanctions will highly affect its manufacturing. Commonly, Huawei used to design the chips they needed. At the same time, the manufacturing part leaves to professional chips factories around the globe, such as the Taiwan Semiconductor Manufacturing Company, since Huawei could not produce the chips in demand by itself. According to U.S. policy, all companies that use technology are banned from providing goods and services to Huawei. Hence, if Huawei maintains its current supply and the mobility of its supply chain, the only way is to shift to a chip manufacturing company that does not belong to the U.S. Otherwise, Huawei cannot find appropriate chip factories to process its design.

Nevertheless, most factories are somehow under the control of the U.S. since it owns the most advanced technology around the globe. For instance, Intel, NVIDIA, QUALCOMM, AMD, SK HYNIX, TEXAS INSTRUMENTS, and MICRON. Since

most of the companies belong to the U.S., Huawei has faced a tough time getting chips. Moreover, Huawei is losing its original market share in the smartphone industry since it cannot offer their consumer the best products, which causes a substantial financial loss for Huawei. In the third quarter Xiaomi (a Chinese company that produces phones) shipped 47m smartphones worldwide, up by 45% year on year. Huawei hawked more handsets, 52m units, but that is down by 23% from a year ago, and the next quarter will almost certainly be even weaker [11].

Meanwhile, another part of the supply chain being affected is the inventory. Considering that the strict policy does not work immediately, Huawei still got some time to prepare and react; in fact, Huawei had tried every possible measure before the ban came into force to ensure the stability of its future chips supply. "According to Huawei's latest financial report data, in 2019 and the first half of 2020, Huawei's inventory continued to rise sharply, increasing more than 73.5% in 2019. By the end of the first half of 2020, Huawei's inventory had reached 180.39 billion yuan [10]." These actions may put additional pressure on Huawei's budget due to high inventory costs, especially since these chips have to stay in the inventory until running out.

4 Conclusions

We have mentioned before that the decline in sales of Huawei's mobile phone business is due to the sanctions imposed by the United States. For the company's business of mobile phones' overall decline in sales and profit shrinkage, we suggested Huawei should consider to improve efficiency of their manufacturing in 5G chips; As Chairman of Huawei Guo Ping Presented in the speech, "Survival is the key for us now, we will now work hard to figure out how to survive. [12]" Here are Huawei's solutions to Huawei's dilemma.

Firstly, Catherine, a member of Huawei's board of directors, said that although the U.S. has been declared sanction to Huawei. Huawei still get their ways to reduce the negative impacts, such as artificial intelligence and electric vehicles, while by passing U.S. patents. In other words, Huawei needs do the research and develop in other areas to make them back to the global business positions as they used to be. Which means, Huawei need to do focus on other Huawei products instead of Phone's market. At the same time, Huawei can still continuing do research and develop in their 5G chips for the mobile. As Catherine said, they have strong confidence in Huawei's R&D investment. In her words, "Our R&D investment this year will remain around \$20bn (£14.5bn). According to a report from Europe, Huawei has ranked as one of the top R&D spenders for ten consecutive years. We also rank among the top companies regarding patent applications [7]." In research and development, Huawei is about to do a big project on electric cars and operating systems. According to Bloomberg, "Huawei Technologies Co. will invest \$1 billion on researching self-driving and electric-car technologies, accelerating plans to compete with Tesla Inc. and Xiaomi Corp. in the world's biggest vehicle arena [8]." It's a sign that Huawei is taking the electric car market seriously, a symbol of its shift in corporate focus.

Secondly, Huawei is also selling part of its handset business to keep the rest of its business running. Not only that, but Huawei has also responded to U.S. sanctions by developing its own operating system, called Harmony OS. According to the official website, Harmony OS, it is an Android-like operating system that Huawei began developing in 2012. Huawei's goal is to turn Harmony into an eco-connected operating system. For example, Harmony OS phones can connect to smart household appliances and the Huawei cars we mentioned and use the phone to control the air conditioning lights. According to a Huawei news conference, by the end of 2021, The Harmony system had been installed on 220 million devices. At the same time, Huawei released its first electric vehicle, the M5, equipped with Huawei's Harmony operating system. Huawei fulfilled its plan in 2019, but the quality needs to acquire market approbation. It will take time to tell whether Huawei can find a lifeline under sanctions. In conclusion, Huawei got quite a destructive impact on their phone's market. And Huawei is trying to make its new legend by showing its strong authority. In doing so, Huawei is also not only to rush to develop 5G chips but also can develop a new way to re-occupy the technological market, for example, E-cars.

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