



Sovereignty in the Semiconductor Supply Chain- Taiwan's Role in the Geo-Technology Battlefield

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The concept of 'sovereignty' in the semiconductor supply chain has sparked significant debate. This article will first explain the semiconductor supply chain and then explore why 'sovereignty,' traditionally a political term, is applied in this commercial context. Moreover, it addresses the role of Taiwan in the current technological battle between the US and China emphasizing the importance of robust technology manufacturing in this rivalry.

Global Value Chains Shape Semiconductor Manufacturing

Semiconductors, commonly known as "chips," are essential components that power electronic devices. Their applications span both civilian and military sectors. These crucial components are integrated into a diverse array of products, including computers, mobile phones, vehicles, and household appliances. Their manufacturing process is closely connected to the global value chain (GVC), indicating that semiconductor production is distributed across various regions worldwide, making it a cornerstone of globalisation. Supply chains, whether in the semiconductor

industry or other sectors, function based on Ricardo's Principle of Comparative Advantage (Irwin, 2017). If a country excels in producing a specific type of product, it should focus on manufacturing that product to maximise profits. Most semiconductor design companies are in the US. American designers excel in semiconductor R&D and own critical intellectual property rights.

East Asia Dominance in Semiconductor Manufacturing

While American companies excel in semiconductor design, they do not handle production. The primary high-end producers,

called foundries, are located in East Asia, with Taiwan Semiconductor Manufacturing Company (TSMC) in Taiwan and Samsung in South Korea being notable examples. TSMC and Samsung account for 70% of global semiconductor manufacturing (53.6% and 16.3%, respectively) (Financial Times, 2022). TSMC is the leading manufacturer of 'advanced logic chips' as of April 2024 and has the capacity for volume production of 3nm technology (N3) (TSMC, 2022). Samsung, on the other hand, is making significant efforts to catch up with TSMC. Samsung started volume production of 3nm chips in June 2022 (Hwang, 2023), a few months before TSMC. However, Samsung's yield rate was much lower than TSMC's. Therefore, despite Samsung commencing production earlier, it is actually TSMC that has maintained a much larger global market share in the advanced 3nm technology sector.

US-China Tech War Intensifies Focus on Semiconductor Sovereignty

How did the concept of 'sovereignty' become intertwined with the supply chain? It is closely linked to the notion of decoupling, particularly evident in the efforts of both the US and China. Both nations seek to decouple from each other, primarily motivated by concerns for national security. The movement towards economic nationalism accelerated with the onset of the trade and technology war in 2018. In the US, this trend was initiated by Trump's trade war and later reinforced by the Biden administration's export controls on strategic industries associated with China. This policy affects American companies and their international trade partners.

In China, the goal to decouple is highlighted by initiatives such as Made in China (MIC). This bilateral intention to decouple underscores the complexities of global economic relations and the evolving dynamics of sovereignty in the context of supply chains.

This policy's objective is to bolster China's own research and innovation capabilities. Notably, the inspiration for MIC came from Germany's 'Industry 4.0' (I40) strategy, a state-led initiative launched in 2013 aimed at maintaining German leadership in technology and mechanical engineering (Anonymous contributor, Background, June 2018). It's crucial to acknowledge that the Made in China (MIC) initiative is comprehensive in scope. Additionally, while the policy underscores the integration of IT and industry, it also aims to enhance China's capabilities in innovation, quality, value, and environmentally friendly industrial practices. Notably, the cultivation of indigenous technology and innovation began after President Xi assumed office in 2013. This initiative aligns with Xi's vision for modernising China's military force, which includes reducing the number of military personnel and enhancing capabilities in 'smart warfare,' such as strategic and tactical missile operations, as well as cyber, space, and electronic warfare under the strategic support force. All these intentions of 'levelling-up' require China's technology development to rely more on indigenous technology because of the direct impact on national interests and security.

The Complete Ecosystem behind Taiwan's Semiconductor Dominance

No matter how fierce the US and China are rivals in the field of semiconductors, neither can mass-produce advanced chips. As mentioned earlier, the key producer is TSMC, headquartered in Taiwan. There are several reasons why advanced semiconductor production in Taiwan is inimitable. Firstly, it stems from the strategic business decisions made by TSMC's former CEO, Morris Chang, in the 1990s. TSMC decided against branding any devices with its name and instead focused on supplying chips to major global brands, including Apple, Intel, Huawei (until 2020),¹ and Samsung. This decision reassured customers that they would not face competition from TSMC when contracting for

chip design. The second reason is TSMC's strong focus on research and development in manufacturing. TSMC has created a vast network that serves as a repository of chip manufacturing knowledge. This collective knowledge base is constantly evolving and updating in real-time, something companies like Samsung or Intel, which have fewer customers, may struggle to match. TSMC's extensive customer network is a testament to years of effort in earning and maintaining customer trust. Trust between designers and manufacturers is the final crucial element. To cultivate this trust, TSMC places great emphasis on exceptional customer care. In its early years (the early 1990s), TSMC underwent a series of rigorous certification procedures by major US semiconductor firms such as Intel. This certification was essential in establishing customer faith and confidence in TSMC's manufacturing quality.² TSMC demonstrates its dedication to customers through personalized service, assigning a dedicated team to each customer. Engineers at TSMC concentrate exclusively on their specific projects, ensuring focus and efficiency. Engineer teams are not privy to production details from other sections. Moreover, Taiwan's comprehensive semiconductor ecosystem, with a deeply embedded supply chain, supports and enhances TSMC's operations.

Taiwan's Semiconductor Industry Thrives Under Democratic Principles

It is essential to understand that TSMC operates independently and is not a state-owned enterprise. Even though TSMC plays an indispensable role in advanced semiconductor manufacturing, the Taiwanese government does not dictate its investment or development strategies. As a democracy, Taiwan's government has limited control over business operations. Nevertheless, Taiwan is home to TSMC and a thriving semiconductor manufacturing ecosystem,

with most high-skilled engineers being Taiwanese and advanced chip production centered in local foundries. It is because of these reasons, rather than any mandates from the Taiwanese government (which likely has minimal influence on TSMC and related semiconductor industries), that Taiwan's robust advanced semiconductor production will remain a key advantage in the ongoing geo-technological rivalry.

Notes and References

- 1 TSMC stopped servicing orders from Huawei in 2020 (Hille and Stacey, Financial Times, June 9 2020).
- 2 Access to Intel was secured partly through the personal connection and professional background of Morris Chang (Wu et al, 2006:442).
- 3 Anonymous contributor. (2018, June). Made in China 2025. Development Policy, Institute for Security and Development Policy. Retrieved August 10, 2023, from <https://isdip.eu/content/uploads/2018/06/Made-in-China-Backgrounder.pdf>
- 4 Financial Times. Samsung slips further behind TSMC in the chipmaking race. (2022, July 17). Retrieved July 22, 2022, from <https://www.ft.com/content/bb13d912-773a-4c1a-bf33-358b3c40ca5a>
- 5 Hille, K. & Stacey, K. (2020, June 9). TSMC falls into line with US export controls on Huawei. Financial Times. Retrieved June 6, 2023, from the Financial Times website
Hwang, J.-S. (2023, April 30). Samsung foundry backlogs top \$74.6 bn for logic chip biz goal. The Korean Economic Daily. Retrieved August 17, 2023, from The Korea Economic Daily website
- 6 Irwin, D. (2017, April 19). Ricardo and comparative advantage at 200.
- 7 Retrieved August 12, 2023, from the Center for Economic and Policy Research (CEPR) website
- 8 TSMC News. (2022, December 6). Retrieved February 4, 2023, from <https://pr.tsmc.com/english/news/2977>



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Chun-Yi's first book was published by Routledge in 2011: *Taiwanese Business or Chinese Security Asset*. The book is under Leiden Series in Modern East Asia History and Politics. In 2010, Chun-Yi received the Economic and Social Research Council (ESRC) standard grant with Prof. Andreas Bieler on a three-year project, 'Globalisation, national transformation and workers' rights: An analysis of Chinese labour within the global economy'. In 2014, Chun-yi received a two-year research grant from the Chiang-Ching-kuo (CCK) Foundation in Taiwan in relation to 'Chinese Investment in Taiwan: Challenge or Opportunity for Taiwan's Industrial Development'. Chun-yi edited numerous books since 2018, most recently In 2023, along with Michael Reilly, Chun-yi edited a book: *China, Taiwan, UK and the CPTPP: Global Partnership or Regional Stand-off?* published by Palgrave. Currently, Chun-yi is working on her second single authored monograph on the topic of 'Sticky Decoupling: Geopolitics and Semiconductor supply chain'.