

Uncovering Huawei's Shadow Network:

The Role of SZMII and Taiwanese Suppliers in
China's Semiconductor Strategy

Tsai-Yi Wang, Adjunct Analyst
Min-Yen Chiang, Non-resident Fellow

Dec. 2024

Uncovering Huawei's Shadow Network:

The Role of SZMII and Taiwanese Suppliers in China's
Semiconductor Strategy

Tsai-Yi Wang, Adjunct Analyst
Min-Yen Chiang, Non-resident Fellow
Dec. 2024

About DSET

Emerging technologies are dramatically transforming the political, economic, and social environments globally. It is crucial to mitigate their negative impacts and steer their use towards improving societal well-being. This requires the formulation of holistic, interdisciplinary policies that deeply consider human and societal concerns to effectively assess and respond to how these technologies affect democracy and society.

In Taiwan, the challenge is the cross-border influence of digital authoritarianism. To counter this, it is essential to develop a governance strategy that safeguards the democratic system, strengthens national security, and fosters social equality.

The National Science and Technology Council has sponsored the creation of the Research Institute for Democracy, Society and Emerging Technology (DSET) to address these critical issues. As a national think tank, DSET's mission is to generate policy recommendations that cater to the democratic and societal needs while providing a distinct Taiwanese perspective to the global community.

DSET is guided by five principal values: democracy, inclusiveness, sustainability, resilience, and innovation. These values direct the institute's efforts in shaping technological development that prioritizes the benefits of democracy.

The name DSET emphasizes democracy ("D") as the foundational element, symbolizing its pivotal role in our policy research. This choice underscores the idea of letting democracy set the direction for technological advancements that enhance public welfare through upholding democratic principles.

**© 2024 by Research Institute for Democracy, Society, and Emerging Technology.
All rights reserved.**

Research Institute for Democracy, Society, and Emerging Technology

4F., No. 7-1, Dehui St., Zhongshan Dist., 10491 Taipei Taiwan

contact@dset.tw

+886 2 2596 5550 | <https://dset.tw>

Acknowledgments

On behalf of the Research Institute for Democracy, Society and Emerging Technology (DSET), we extend our deepest gratitude to the numerous individuals and organizations whose generous support and unwavering commitment have been instrumental in our pursuit of a more democratic, inclusive, and technologically advanced society.

We are particularly thankful to the National Science and Technology Council for their sponsorship and continued faith in our mission. Their support not only empowers our research but also reinforces Taiwan's commitment to maintaining a democratic ethos in the face of global technological challenges.

Our sincere appreciation also goes out to our fellow researchers and staff, whose dedication and expertise drive the core of our operations. Their relentless pursuit of knowledge and innovation ensures that our work not only meets but exceeds the rigorous standards of scholarly excellence.

We also thank the international community for their collaboration and engagement. Their diverse perspectives enrich our understanding and help to disseminate our findings on a global scale, promoting the values of democracy and technological governance worldwide.

Lastly, we acknowledge the citizens of Taiwan, whose resilient support for democratic values inspires our work every day. It is for them that we strive to craft policies that ensure technology serves as a bridge to a more equitable and prosperous future, rather than a barrier.

Together, with the support of these vital partners, DSET is set to continue leading the way in shaping a future where technology and democracy thrive in harmony.

Contents

| | |
|--|----|
| List of Tables | 5 |
| List of Figures | 5 |
| Summary | 8 |
| The Business Model of Chinese Chips Fabs with their Taiwanese Suppliers | 10 |
| Shenzhen as a Leading City: The State-Owned Investment for Self-Sufficiency | 14 |
| Briefing on Shenzhen Major Industry Investment | 14 |
| SZMII's Three Approaches for Advancing Chip Industry | 16 |
| Taiwan's First "T+A" Cleanroom Company in China | 21 |
| Brief Introduction of the Taiwanese Cleanroom Builder | 21 |
| 1978 – 2002: From Air Conditioning to Cleanroom | 23 |
| 2002 – 2016: Landing in China | 24 |
| The First "T+A" Company and the Dual Capital Markets | 29 |
| 2016 – : Recent Development | 34 |
| Implications for Taiwan's Economic Security | 40 |
| Taiwanese Semiconductor Technology Integrated into Shenzhen's "Third Pole" Strategy | 42 |
| Appendix | 44 |

List of Tables

Table 1: Szmii's Three Approaches for Advancing the Chip Manufacturing Industry

Table 2: Shareholder Contributions and Shares in SMIC (Shenzhen)

Table 3: L&K Engineering's Development

Table 4: L&K Engineering's Sources of Revenue, Sorted by Country Sorted by Country
(in Thousand NTD)

List of Figures

Figure 1: Shenzhen Major Industry Investment Group Structure (Simplified)

Figure 2: SZMII Ownership on the Three Startups

Figure 3: The Connection Between SZMII's Startups and L&K Engineering

Figure 4: L&K Engineering's Major Clients in Each Stage of Development

Figure 5: The Development of UMC and L&K Engineering in China

Figure 6: Divergent Development Paths of UMC and L&K Engineering Under Taiwan's
Outbound Investment Review

Figure 7: L&K Engineering's Sources of Revenue, Sorted by Country (%)

Figure 8: L&K Engineering's Sources of Revenue, Sorted by Country (in Billion NTD)

Appendix

L&K Engineering's Ongoing Projects Every Year Sorted by Corporation

Parallel Texts

| English | Chinese |
|---|---------------------------|
| China Integrated Circuit Industry Investment Fund | 國家大基金（國家集成電路產業投資基金股份有限公司） |
| Shenzhen Major Industry Investment Group Co., Ltd. | 深圳市重大產業投資集團公司 |
| People's Government of Shenzhen Municipal | 深圳市人民政府 |
| State-owned Assets Supervision and Administration Commission of the People's Government of Shenzhen Municipal | 深圳市人民政府國有資產監督管理委員會 |
| PXW Semiconductor Manufactory Co., Ltd. | 深圳市鵬芯微集成電路制造有限公司 |
| SwaySure Technology Co., Ltd. | 深圳市昇維旭技術有限公司 |
| Shenzhen Pengxinxu Technology Co.,Ltd. | 深圳市鵬新旭技術有限公司 |
| Serve the nation's core strategies as Shenzhen being the leading city of China | 服務國家核心戰略，凸顯深圳城市擔當 |
| The third pole of integrated circus industry | 集成電路產業發展第三極 |
| Advancing the chip industry for the party's interest | 弘芯向黨 |
| Semiconductor Manufacturing International (Shenzhen) Corporation | 中芯國際積體電路製造（深圳）有限公司 |
| SMIC Holdings Ltd. | 中芯國際控股有限公司 |
| SMIC Investment (Shanghai) Ltd. <i>(to be confirmed)</i> | 中芯集電投資（上海）有限公司 |
| Shenzhen Founder Microelectronics International Co., Ltd. | 深圳方正微電子有限公司 |
| Century Science & Technology Investment Corporation | 深圳市深超科技投資有限公司 |
| Shenzhen Shenxingxu Technology Development Co., Ltd. | 深圳市深星旭科技發展有限公司 |
| Shenzhen Shenxingheng Technology Development Co., Ltd. <i>(to be confirmed)</i> | 深圳市深星恒科技發展有限公司 |
| Shenzhen Xingheng Chuangxin Technology Partnership (Limited Liability) <i>(to be confirmed)</i> | 深圳市星恒創芯科技合夥企業（有限責任） |
| Zhou Jing | 周勁 |
| Tsinghua Unigroup Co., Ltd. | 紫光集團有限公司 |

| English | Chinese |
|---|--------------------|
| Liu Shiao-Chiang | 劉曉強 |
| L&K Engineering Co., Ltd. | 亞翔工程股份有限公司 |
| L&K Engineering (Suzhou) Co., Ltd. | 亞翔系統集成科技(蘇州)股份有限公司 |
| RSEA Engineering Corporation | 榮工工程股份有限公司 |
| Yao Tsu-Shiang | 姚祖驥 |
| Dah Cheng Construction & Engineering Co., Ltd. | 達正工程股份有限公司 |
| Shin-pu Institute of Technology | 新埔工業專科學校 |
| No haste, be patient | 戒急用忍 |
| HeJian Technology Corporation | 和艦晶片製造(蘇州)股份有限公司 |
| Hsu Jian-Hua | 徐建華 |
| Robert Hsing-cheng Tsao | 曹興誠 |
| Hsuan Ming-chih | 宣明智 |
| Veterans Affairs Council | 國軍退除役官兵輔導委員會 |
| Shanghai Stock Exchange | 上海證券交易所 |
| Taiwan Stock Exchange | 臺灣證券交易所 |
| Shenzhen Stock Exchange | 深圳證券交易所 |
| Beijing Stock Exchange | 北京證券交易所 |
| China Security Regulatory Commission | 中國證券監督管理委員會 |
| Data Systems Consulting Co., Ltd. | 鼎新電腦股份有限公司 |
| Digiwin Software Co., Ltd. | 鼎捷軟件股份有限公司 |
| Liu Fang-Jong | 劉芳榮 |
| Fu-La-Kai Investment Bank | 富拉凱投資銀行 |
| Chen Shu-Chen | 陳淑珍 |
| Foxconn Technology Group | 鴻海科技集團 |
| Foxconn Industrial Internet | 工業富聯 |
| Zhen Ding Tech. Group | 臻鼎科技集團 |
| Avary Holding (Shenzhen) Co., Ltd. | 鵬鼎控股(深圳)股份有限公司 |
| Giant Manufacturing Co., Ltd. | 巨大機械工業股份有限公司 |
| D.MAG New Material Technology Co., Ltd. | 鼎鎂新材料科技股份有限公司 |
| Sunjuice Holdings Co., Limited | 鮮活控股股份有限公司 |
| Sunjuice Co., Ltd | 蘇州鮮活飲品公司 |
| Li Chung-Hsian | 李忠憲 |
| Yangtze Memory Technology Corp. | 長江存儲科技有限責任公司 |
| Taiwan Chip-based Industrial Innovation Program | 晶創計畫 |

Summary

1 Under the Chinese central government's push for self-sufficiency in semiconductor technology, the Shenzhen municipal government aims to establish itself as China's "Third Pole" in the semiconductor industry. With strong government industrial policy support, Shenzhen is striving to build a complete semiconductor supply chain, mirroring the developments seen in Beijing and Shanghai. At the forefront of this initiative is the Shenzhen Major Industry Investment Group (SZMII). SZMII drives industry growth through three main strategies: attracting existing corporations, making acquisitions, and launching new small companies. A key aspect of their strategy involves assisting Huawei in creating its shadow network, further embedding state influence into the semiconductor sector. Among the numerous semiconductor companies backed by SZMII, PXW, a producer of 28/20nm chips, Pengxinxu, a manufacturer of 40/28nm chips, and Swaysure, a DRAM manufacturer, have drawn international attention due to U.S. sanctions.

2 Taiwanese semiconductor companies continue to maintain a notable presence in China's domestic supply chains, with their dynamics evolving alongside the expansion of Huawei's shadow network. By examining their trajectories from Taiwan to China, we can identify broader challenges in contemporary economic security. L&K Engineering, a company specializing in cleanroom engineering,

grew under various government-driven industrial policies and benefited significantly from the development of Taiwan's semiconductor industry within its science parks. In the early 2000s, the company, alongside chip manufacturers, began investing in China to capitalize on opportunities in the Chinese market. However, unlike chip manufacturers such as UMC, which faced strict government scrutiny due to their advanced semiconductor technologies, cleanroom builders like L&K Engineering were not subject to the same regulatory oversight. This regulatory leniency allowed major Chinese semiconductor firms, including SMIC and Fujian Jinhua, to maintain access to Taiwanese cleanroom engineering technology. L&K Engineering also became Taiwan's first "T+A" company, listed on both the Taiwan Stock Exchange and the Shanghai Stock Exchange. In recent years, the company has not only expanded its operations in China but has also leveraged its Chinese subsidiary to secure business opportunities in Southeast Asia.

3 SZMII, Huawei, and Huawei's shadow network demonstrate how Shenzhen's local industry policies successfully attract foreign technology investments. Notable examples include SMIC establishing foundries in Shenzhen and L&K Engineering providing essential supplies. As a result, the Taiwanese company L&K Engineering has been integrated into Shenzhen's autonomous semiconductor development strategy. This integration enables L&K Engineering to thrive in the Chinese market despite the ongoing U.S.-China technological rivalry. L&K Engineering's listed Chinese subsidiary has completed local compliance reviews and secured development opportunities in both China and Southeast Asia. These achievements have led to significant localization. Consequently, it may become increasingly difficult for the Taiwanese government to prevent L&K Engineering's Chinese subsidiary from further aligning with the Chinese market in the future.

4 Regulating non-core technology semiconductor suppliers is challenging. While the disparity in regulatory intensity is understandable due to the different types of technologies involved, it does little to alleviate the challenge posed by China's growing semiconductor autonomy. Huawei's increasingly mature supply chain threatens not only international economic security but also Taiwan's national security. However, relying solely on the Taiwanese government to enforce controls raises critical questions: Can Chinese domestic companies easily replace the contributions of Taiwanese firms? And might companies from other countries inadvertently take their place? Thus, multilateral frameworks among like-minded countries are urgently needed to establish common and effective regulatory standards. Moreover, it is crucial to seek diversified international market opportunities for semiconductor companies outside of China.

The Business Model of Chinese Chips Fabs with their Taiwanese Suppliers

Is Huawei making a comeback?

Five years have passed since the U.S. government imposed sanctions on Huawei, yet whether the sanctions have successfully forestalled China's progress in self-sufficiency remains debatable. In 2019, Huawei was added to the Entity List of the U.S. Bureau of Industry and Security (BIS), which means Huawei is prohibited from acquiring certain products and materials from the U.S. companies.¹ In 2022, the CHIPS and Science Act forbade all state-funded U.S. tech companies conducting the advanced process in China. Now, the U.S. persons are not allowed to work in China's advanced semiconductor industry. In addition, advanced technology, such as AI and GPU, can only be exported to China after being censored.²

However, Huawei continues to roll out high-end cell phones regardless of the blockade, indicating that China's semiconductor industry is not defeated yet. Some arguments suggest that U.S. export controls are ineffective, as highlighted in a Nikkei Asia report published at the end of August 2024. The report detailed how TechanaLye, a Japanese reverse engineering firm, analyzed the components of the Huawei Pura 70 Pro and compared them with equivalent parts manufactured by TSMC. Surprisingly, the company found that the KIRIN 9010 chip in the Huawei Pura 70 Pro, designed by Huawei's chip design subsidiary Hisilicon and manufactured by SMIC, was as powerful as the KIRIN 9000 chip designed by Hisilicon and produced by TSMC in 2021. TechanaLye concluded that SMIC is only three years behind TSMC and argued that U.S. sanctions are actually fostering the self-sufficiency of China's semiconductor industry.³

¹ Bureau of Industry and Security. (n.d.). [What is the entity list?](#) U.S. Department of Commerce.

² Lu, C. H. (2023, August 8). Huawei Unveils the Triple-Folding Mate XT Phone: Has Chinese Technology Overcome U.S. Sanctions [[華為三折疊手機 Mate XT 發佈：中國技術是否已突破美國制裁](#)]. BBC.

³ Hosokawa, K. (2024, August 27). Teardown of Huawei Phone: Chinese Semiconductors Are Only Three Years Behind [[拆解華為手機：中國半導體僅落後3年](#)]. Nikkei Asia.

Although the reverse engineering methods used in the report are questionable—such as not accounting for differences in the semiconductor manufacturing equipment employed by SMIC and TSMC, which could lead to inaccurate assessments—the claims still reflect international uncertainty regarding the effectiveness of export controls. The ongoing debate surrounding Huawei has been further fueled by the recent launch of their latest smartphone, the Mate XT. Released on September 9, 2024, this tri-fold device features Huawei's proprietary HarmonyOS. However, concerns have been raised regarding the yield rate of its most advanced processor, the SMIC-made 910B, which is reportedly as low as 50%.^{*}

Huawei's potential comeback could be mainly attributed to its close collaboration with the Chinese government. In October 2023, Bloomberg reported that Huawei not only utilizes chips from SMIC but is also building its own secret network with the support of the Chinese government.⁴ To address what business mechanisms the Chinese government and Huawei have implemented to break the U.S. blockade, this report studies two cases: Shenzhen Major Industry Investment Group Co., Ltd. (深圳市重大產業投資集團公司, SZMII), the Chinese state-owned investment corporation, and L&K Engineering Co., Ltd. (亞翔工程股份有限公司, L&K Engineering), the Taiwanese cleanroom builder.

Why Shenzhen Major Industry Investment Group?

It is widely-known that the Chinese government heavily supports its semiconductor industry. For example, marching to the third phase, China Integrated Circuit Industry Investment Fund (國家集成電路產業投資基金, ICF) announced its registered capital amounted to 344 billion RMB.⁵ Also, the Chinese government provides favorable interest rates as low as 2.1% to semiconductor corporations like SMIC.⁶ Similarly, China's industrial policies have effectively facilitated the expansion of Huawei's production network in recent years.

SZMII, a investment company owned and managed by the People's Government of Shenzhen Municipal, is the controller of many Huawei-related companies. In December 2022, Chinese startup PXW Semiconductor Manufactory Co., Ltd. (深圳市鵬芯微集成電路制造有限公司, PXW) was added to the U.S. BIS's entity list just eighteen months after its establishment in June

^{*} Potkin, F. (2024, November 20). [Exclusive: Huawei aims to mass-produce newest AI chip in early 2025, despite US curbs](#). Reuters.

⁴ Bloomberg. (2023, October 3). [Taiwan tech companies are helping Huawei build a secret network of chip plants](#).

⁵ Li, Y. W. (2024, May 27). China Establishes the ICF of 1.5 Trillion Yuan to Support the Semiconductor Industry [中國設立國家大基金 1.5 兆元 支持半導體產業]. Central News Agency [中央社].

⁶ Central News Agency [中央社]. (2024, August 5). US Media: China Invests Heavily in Supporting Manufacturing, Leaving Other Countries Far Behind [美媒: 中國斥巨資扶持製造業 他國望塵莫及].

2021. The End-User Review Committee (ERC) explained that this action was taken because PXW was “posing a significant risk of becoming involved in activities contrary to the national security or foreign policy interests of the United States.”⁷ With the former administrative vice president of Huawei serving as PXW's CEO, the close tie between PXW and Huawei was apparent.⁸ In December 2024, the U.S. government announced that 140 Chinese entities were added into the BIS Entity List to further impair China's capability to produce advanced semiconductors. This addition targeted chip manufacturers that collaborate with Huawei, including SwaySure Technology Co., Ltd. (深圳市昇維旭技術有限公司, SwaySure) and Shenzhen Pengxin Technology Co., Ltd. (深圳市鵬新旭技術有限公司, Pengxin). Both companies were accused of potentially contributing to the development of Huawei.⁹ All of the three Huawei-related companies are fully controlled by SZMII, which aims to develop critical bottleneck technologies and build a comprehensive semiconductor supply chain in Shenzhen.¹⁰

To achieve its goal, SZMII employs three approaches: collaboration, acquisition, and startup. Utilizing generous funds provided by the Chinese government, SZMII not only finances mysterious startups to circumvent the U.S. sanction but also invests or acquires existing companies like SMIC to advance the Shenzhen semiconductor industry. The case of SZMII demonstrates how a state-owned investment corporation helps Huawei building its shadow network and integrates the local industry.

Why L&K Engineering?

Taiwanese companies are supplying Huawei and other sanctioned Chinese companies with essential but not forbidden technology, material, and service. In October 2023, Bloomberg revealed that four Taiwanese firms were helping Huawei-related companies to build plants. They were mainly engaged in construction services, such as wastewater treatment, chemical supply system, and renovation projects. Because these are not considered to be critical technology that should be carefully guarded, the Taiwanese firms claimed their businesses with Huawei-related companies to be legitimate.¹¹ In fact, Taiwanese companies flooded

⁷ Bureau of Industry and Security. (2022, December 19). [Additions and revisions to the entity list; revisions to the unverified list](#). Federal Register.

⁸ Li, R. J. (2022, October 6). Shenzhen's "PXW" Suspected of Helping Huawei Evade US Sanctions; Founder Shares the Same Name as Huawei's Former Vice President. [深圳「鵬芯微」疑助華為避美制裁 創辦人與華為前副行政總裁同名]. Radio Free Asia.

⁹ Bureau of Industry and Security. (2024, December 2). [Additions and Modifications to the Entity List; Removals from the Validated End-User \(VEU\) Program](#). Federal Register.

¹⁰ State-owned Assets Supervision and Administration Commission of the People's Government of Shenzhen Municipal [深圳市人民政府國有資產監督管理委員會]. (2022, April 24). Building, strengthening, and reinforcing the supply chain, Shenzhen Capital Group contributes core strength [建鏈補鏈強鏈·深重投資獻硬核力量].

¹¹ Bloomberg. (2023, October 3). [Taiwan tech companies are helping Huawei build a secret network of chip plants](#).

into the Chinese market early in the beginning of the 21st century and have since flourished alongside China's semiconductor industry.

L&K Engineering is one of Taiwan's leading cleanroom suppliers, serving clients such as UMC and TSMC. It is an interesting example of how Taiwanese semiconductor-related firms entered and thrived in the Chinese market during the 2000s. The strong relationship between UMC and L&K Engineering was established at the end of the 20th century. In 2002, UMC brought L&K Engineering to China to build the 8-inch foundry for its subsidiary, HeJian Technology.¹² This project enabled L&K Engineering to establish a presence in China and gain a reputation in the cleanroom business, allowing it to attract Chinese clients.¹³

Besides building fabs for HeJian, L&K Engineering's clients include TSMC's production facility in China—TSMC Nanjing.¹⁴ L&K Engineering also undertakes projects for major Chinese semiconductor manufacturers such as SMIC, Fujian Jinghua, and Huawei-backed companies like PXW and Pengxinu.¹⁵ From 2016 to 2019, revenue from Chinese clients accounted for nearly half of L&K Engineering's total revenue.¹⁶ The number of projects undertaken further underscores the company's strong focus on the Chinese market; between 2017 and 2024, the company completed 17 projects for SMIC alone.¹⁷ In addition, L&K Engineering is the first "T+A" company, meaning that its Taiwanese parent company is listed on the Taiwan Stock Exchange (臺灣證券交易所, TWSE), while its Chinese subsidiary is listed on the Shanghai Stock Exchange (上海證券交易所, SSE).¹⁸

L&K Engineering's presence in the Chinese stock market, on the one hand, raises questions about how the listing of Taiwanese companies in China might impact the Taiwanese industry. On the other hand, the company has played a significant role in the development of China's semiconductor industry by contributing to numerous cleanroom projects. The strong ties between L&K Engineering and the Chinese market stem from the company's development history, and it is on this foundation that the Huawei-related incident also emerged.

¹² Lin, W. C. (2017, April 12). L&K Engineering's New Listing Model: China's Market Value is Four Times That of Taiwan, Influencing a New Relationship Between Taiwanese Companies and China's Capital Markets [亞翔掛牌新模式 中國市值是台灣的 4 倍牽動台灣企業與中國資本市場新關係]. Wealth Magazine [財訊].

¹³ L&K Engineering (Suzhou) [亞翔集成]. (n.d.). [Company profile: Development History](#).

¹⁴ L&K Engineering (Suzhou) [亞翔集成]. (2019, June 6). TSMC (Nanjing) Co., Ltd. and Fab 16 [台積電(南京)有限公司及晶圓十六廠].

¹⁵ L&K Engineering [亞翔工程]. (2024, June). Annual report 2023.

¹⁶ L&K Engineering [亞翔工程]. (2010–2023). Financial statements 2010–2023.

¹⁷ L&K Engineering [亞翔工程]. (2017–2024). Handbooks for the Annual Meetings of Shareholders 2017–2024.

¹⁸ Yang, R. S. (2016, December 30). Suzhou L&K Engineering Goes Public; T+ A-Share Interaction Becomes the Focus [蘇州亞翔今上市 T + A 股互動成焦點]. China Times [中國時報].

Shenzhen as a Leading City: The State-Owned Investment for Self-Sufficiency

Briefing on Shenzhen Major Industry Investment

As the U.S.-China technology war broke out in 2018, SZMII was established in May 2019. Fully controlled by the State-owned Assets Supervision and Administration Commission of the People's Government of Shenzhen Municipal (深圳市人民政府國有資產監督管理委員會, SASAC (Shenzhen)), SZMII's mission is consistently stated on its website and press releases: "serve the nation's core strategies as Shenzhen being the leading city of China (服務國家核心戰略, 凸顯深圳城市擔當)"¹⁹. For the People's Government of Shenzhen Municipal, the development plan should not only boost Shenzhen's economy, but also support China's ambition to build self-sufficient networks in critical technologies.

In terms of regional development, Shenzhen strives to become "the third pole of integrated circuit industry (集成電路產業發展第三極)", following Shanghai and Beijing. To achieve this, SZMII is dedicated to navigating the development of Shenzhen "20+8" industries, which means twenty strategic emerging industries and eight industries of the future, especially the semiconductor industry.²⁰ Since the Shenzhen semiconductor industry takes the lead in chip design but lacks chip manufacturers, the Government of Shenzhen Municipal is eager to attract or start up chip manufacturers.²¹ This development path must also be viewed from a national strategy perspective. SZMII is committed to "advancing the chip industry for the party's interest (弘芯向黨)" by focusing on overcoming bottleneck technologies.²² Overall, SZMII aims to lead the development of the Shenzhen semiconductor industry in alignment with the nation's core strategy.

¹⁹ Shenzhen Municipal Investment Industry Group. [深圳市重大產業投資集團公司]. (n.d.). [Corporate structure](#).

²⁰ Shenzhen Tech Information [深科信]. (2023, October 8). The Most Comprehensive! Shenzhen's "20+8" Industry Cluster Plan for Each District [最全! 深圳市各區 "20+8" 產業集群規劃]. Sohu [搜狐].

²¹ Shenzhen Pingshan District Investment Promotion Service Office [深圳市坪山區投資推廣服務署]. (2021, October 21). Public Announcement on the Selection Plan for the 12-Inch Wafer Foundry Production Line Supporting Facilities Project [關於 12 英寸晶圓代工生產線配套廠房項目遴選方案的公示].

²² State-owned Assets Supervision and Administration Commission of the People's Government of Shenzhen Municipal [深圳市人民政府國有資產監督管理委員會]. (2022, April 24). Building, strengthening, and reinforcing the supply chain, Shenzhen Capital Group contributes core strength [建鏈補鏈強鏈, 深重投資貢獻硬核力量].

Shenzhen Major Industry Investment Group Structure (Simplified)

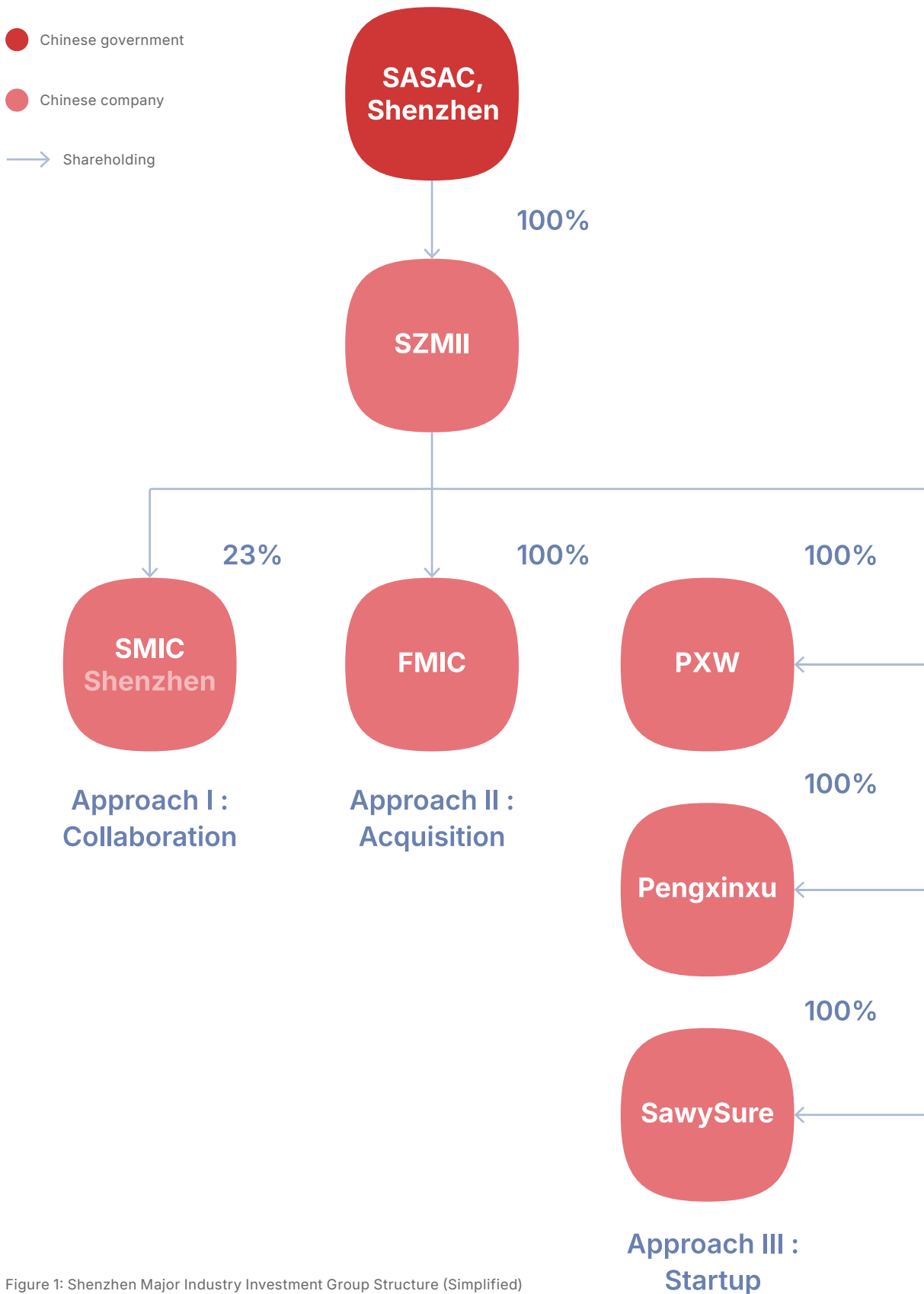


Figure 1: Shenzhen Major Industry Investment Group Structure (Simplified)
Source: TianYianCha

SZMII's Three Approaches for Advancing Chip Industry

SZMII realizes its goal by three approaches: attracting existing corporations, making acquisitions, and starting up small companies. First, SZMII and the ICF offer generous funding, while the government of Shenzhen municipal provides ample lands, to attract existing corporations to set foundries in Shenzhen. One of SZMII's significant achievements is facilitating the establishment of SMIC's foundry in Shenzhen. In March 2021, SMIC officially announced its plan to build a 12-inch wafer foundry in Pingshan, Shenzhen. This foundry is dedicated to the production of 28nm chips and was scheduled to commence operations in 2022, aiming for a capacity of 40,000 12-inch wafers per month.²³ By November 2021, the total investment for the project was confirmed. SZMII and the ICF contributed US\$555.45 million and US\$531.3 million, respectively, accounting for 45% of the total capital investment in Semiconductor Manufacturing International (Shenzhen) Corporation (中芯國際積體電路製造(深圳)有限公司, SMIC (Shenzhen)), SMIC's subsidiary in Shenzhen. In exchange for their investment, SZMII holds a 23% stake in SMIC (Shenzhen).²⁴

SZMII's Three Approaches for Advancing the Chip Manufacturing Industry

| | Description | Example |
|----------------------|--|--|
| Collaboration | Providing funds and land to corporations in exchange of shares and investment in Shenzhen. | SMIC announced in 2021 that the 12-inch wafer foundry would be set in Shenzhen, while SZMII owns 23% of SMIC (Shenzhen). |
| Acquisition | Acquiring a well-established company and converting it into a state-owned enterprise. | FMIC, founded in 2003 and wholly acquired by SZMII-owned corporation in 2021. |
| Startups | Establishing multiple companies to circumvent U.S. sanctions. | PXW (2021), SwaySure (2022), and Pengxinxu (2022), which are 100% owned by SZMII. |

Table 1: SZMII's Three Approaches for Advancing the Chip Manufacturing Industry

Source: Compiled by the authors

²³ Shanghai Stock Exchange. (2021, March 18). Semiconductor Manufacturing International Corporation, Announcement on Voluntary Disclosure of Signing a Cooperation Framework Agreement [中芯國際集成電路製造有限公司關於自願披露簽訂合作框架協議的公告].

²⁴ Shanghai Stock Exchange. (2021, November 24). Semiconductor Manufacturing International Corporation, Announcement on the Establishment of a New Joint Venture Agreement in Shenzhen and Related Party Transactions [中芯國際集成電路製造有限公司關於訂立新深圳合資協議暨關聯(連)交易的公告].

Shareholder Contributions and Shares in SMIC (Shenzhen), 2021

| | Contributions (million USD) | Shares (%) |
|--|--------------------------------|------------|
| SMIC Holdings Ltd. (中芯國際控股有限公司) | 1201.25 | 49.74 |
| SMIC Investment (Shanghai) Ltd. (中芯集電投資(上海)有限公司) | 127.0 | 5.26 |
| Shenzhen Major Industry Investment Group Co., Ltd. | 555.45 | 23.00 |
| China Integrated Circuit Industry Investment Fund | 531.3 | 22.00 |
| Total | 2415 | 100 |

Table 2: Shareholder Contributions and Shares in SMIC (Shenzhen), 2021

Source: Announcement on the Signing of a New Shenzhen Joint Venture Agreement and Connected (Related) Transaction, SMIC, 24 Nov. 2021

SZMII also offers land to SMIC to improve the maturity of the wafer production supply chain. In October 2021, SMIC (Shenzhen) acquired a plot of land in Pingshan with a gross floor area of 69,410 square meters, by securing the bid for 2.1 million RMB.²⁵ This land will serve as a supplementary facility for SMIC's 12-inch wafer production, providing essential gasses and chemicals necessary for chip manufacturing. The deal enhances and strengthens Shenzhen's chip manufacturing industry, which has previously lagged behind Shanghai and Beijing.²⁶ Overall, the investment in SMIC (Shenzhen) boosts Shenzhen's chip manufacturing capacity.

Second, SZMII acquires well-established companies, such as Shenzhen Founder Microelectronics International Co., Ltd. (深圳方正微電子有限公司, FMIC). Founded in 2003,

²⁵ Shenzhen Pingshan District Investment Promotion Service Office [深圳市坪山區投資推廣服務署]. (2021, October 21). Public Announcement on the Selection Plan for the 12-Inch Wafer Foundry Production Line Supporting Facilities Project [關於 12 英寸晶圓代工生產線配套廠房項目遴選方案的公示]. Anue [鉅亨網]. (2021, December 21). SMIC Wins Industrial Land Bid in Shenzhen Pingshan, to Be Used for 12-Inch Wafer Foundry Production [中芯國際競得深圳坪山工業用地 將用於 12 吋晶圓代工].

²⁶ Shenzhen Pingshan District Investment Promotion Service Office [深圳市坪山區投資推廣服務署]. (2021, October 21). Public Announcement on the Selection Plan for the 12-Inch Wafer Foundry Production Line Supporting Facilities Project [關於 12 英寸晶圓代工生產線配套廠房項目遴選方案的公示].

FMIC focuses on advancing the industrialization of power management ICs and new power electronic devices. In 2021, FMIC was acquired by Shenzhen Shenxingxu Technology Development Co., Ltd. (深圳市深星旭科技發展有限公司),²⁷ which is 100% owned by SZMII.²⁸ After the merger, FMIC was further integrated into the semiconductor industry network planned by SZMII.

Lastly, SZMII has launched numerous startups to circumvent U.S. sanctions. This strategic approach enables Huawei to directly manage and shape a shadow supply chain developed by SZMII. For instance, PXW was established in June 2021 and is owned by an SZMII subsidiary. The appointment of Zhou Jing (周勁), the former Vice President of Huawei's administration, as its president highlights PXW's potential collaboration with Huawei.²⁹ This startup specializes in the manufacturing of 28nm and 20nm ICs.³⁰ Beyond PXW, SZMII also extends its influence to both upstream and downstream sectors of the semiconductor industry. SZMII directly holds all shares of five investment or financial companies, which in turn own other firms and invest in each other. Through this intricate network, SZMII controls a total of fifty-seven companies, most of which were established after 2020. These startups operate in various domains, ranging from chemical engineering to chip manufacturing,³¹ thereby creating a comprehensive semiconductor supply chain.

²⁷ Founder Microelectronics International Co., Ltd. [深圳方正微電子有限公司]. (n.d.). [About Us](#).

²⁸ TianYanCha [天眼查]. (n.d.). Company profile: Shenzhen Shenxingxu Technology Development Co., Ltd. [基本信息].

²⁹ Li, R. J. (2022, October 6). Shenzhen's "PXW" Suspected of Helping Huawei Evade U.S. Sanctions; Founder Shares the Same Name as Huawei's Former Vice President. [深圳「鵬芯微」疑助華為避美制裁 創辦人與華為前副行政總裁同名]. Radio Free Asia.

³⁰ PXW [鵬芯微]. (n.d.). [Company profile](#).

³¹ TianYanCha [天眼查]. (n.d.). Overall view of Shenzhen Major Industry Investment Group Co., Ltd. [企業全景].

SZMII Ownership on the Three Startups

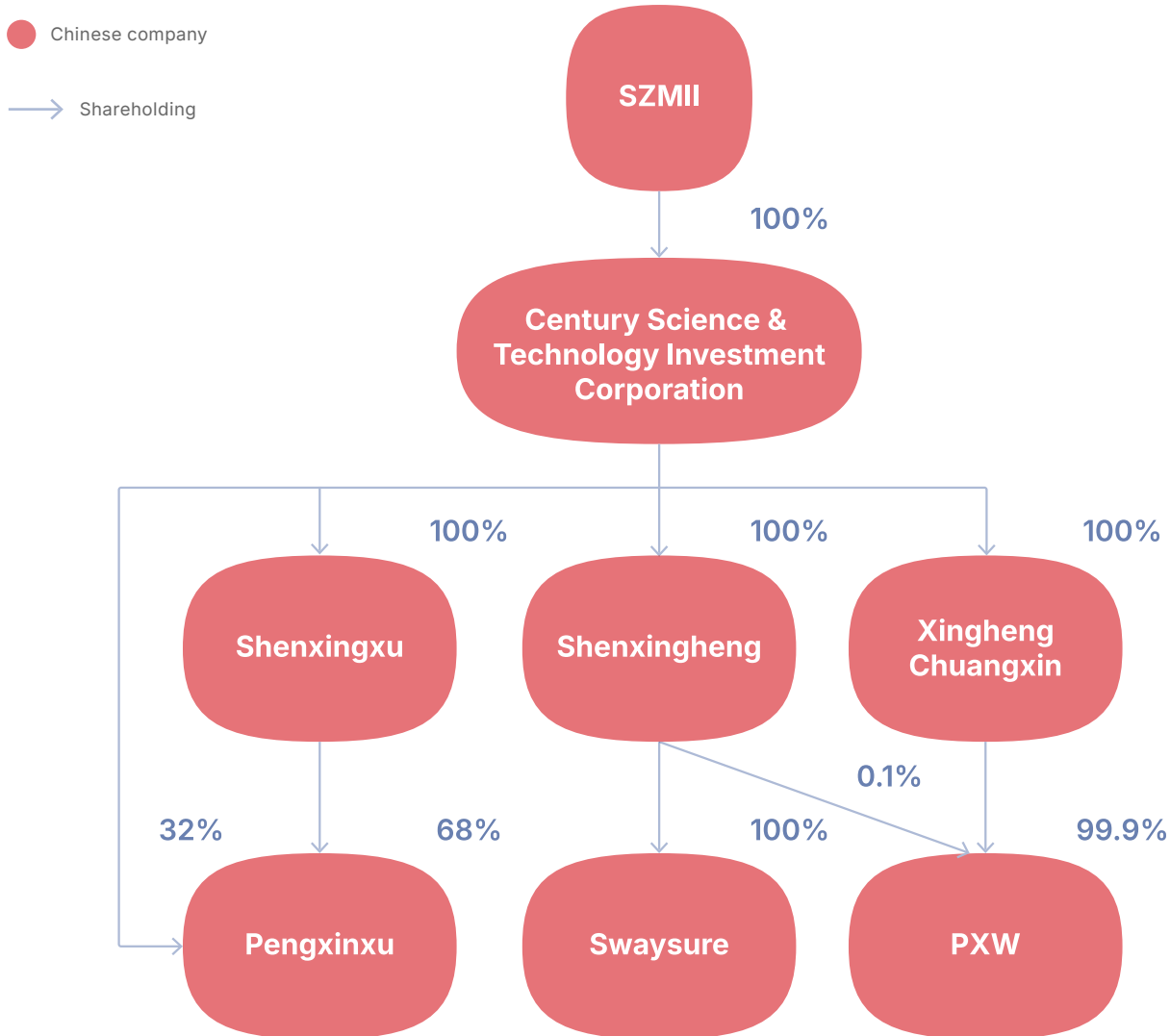


Figure 2: SZMII Ownership on the Three Startups
Source: TianYianCha

To maintain the "shadow" nature of Huawei's supply chain, most of the startups controlled by SZMII remain low-profile. Compared to PXW, which is well-known for its Huawei-backed executives, the other two chip manufacturing firms have received less attention so far. SwaySure, established in March 2022, specializes in DRAM, while Pengxinxu, also established in March 2022, is devoted to 40/28 nm technology IC manufacturing. SwaySure garnered attention when its executive team was announced in June 2022: Yukio Sakamoto, the former CEO of Elpida Memory, Inc. and former Vice President of Tsinghua Unigroup Co., Ltd. (紫光集團有限公司), was appointed as Chief Strategic Officer, and Liu Shiao-Chiang (劉曉強), the former director of TSMC Fab 18, was appointed as CEO. In contrast, information about Pengxinxu is relatively scarce.³²

³² Hong, Y. F. (2022, June 21). Shenzhen State-Owned Assets Commission Establishes DRAM Plant, Poaches CEO from TSMC [深圳國資設 DRAM 廠 執行長自台積電挖角]. The Liberty Times [自由時報].

The Connection Between SZMII's Startups and Taiwanese Cleanroom Builders

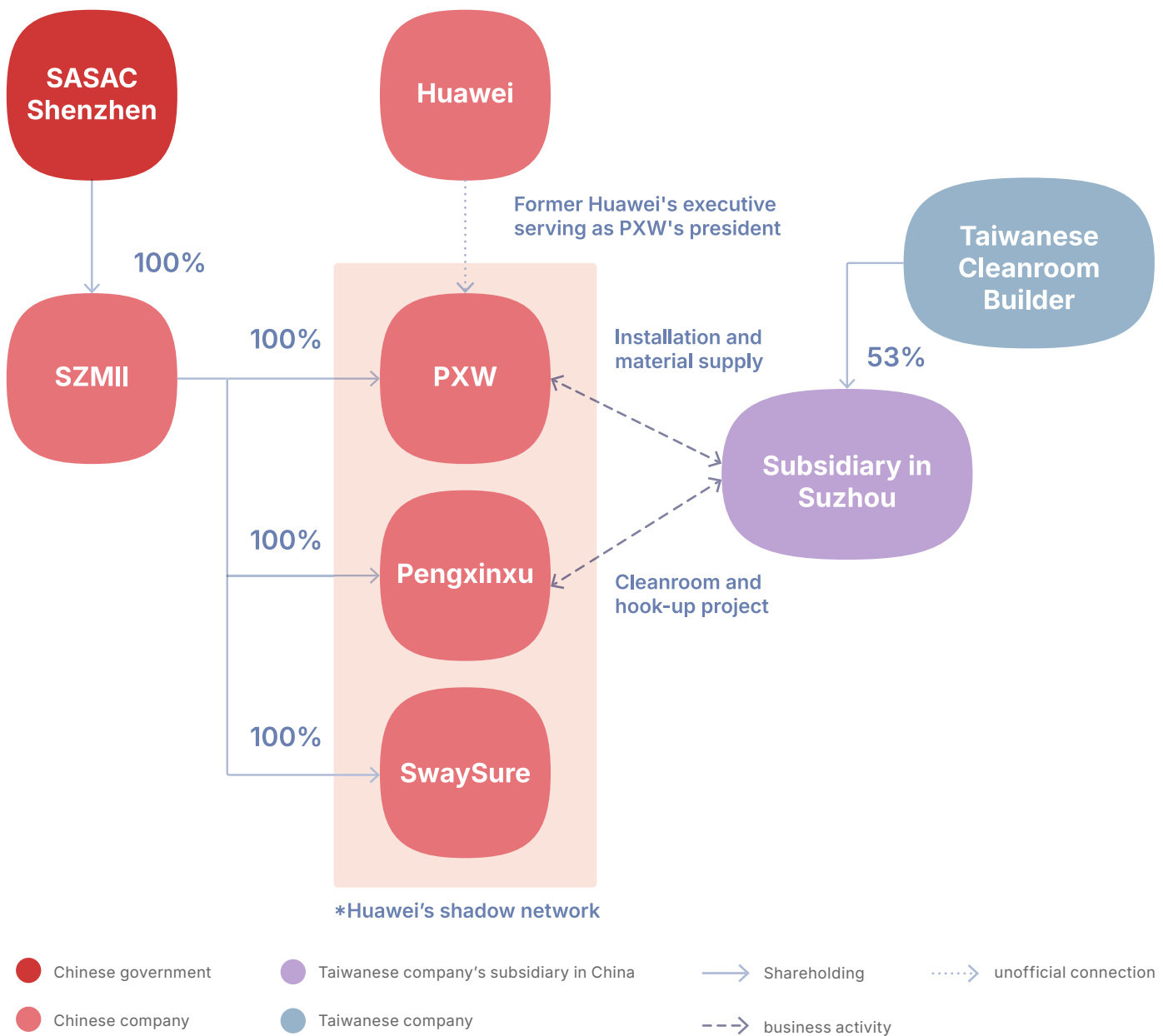


Figure 3: The Connection Between SZMII's Startups and Taiwanese Cleanroom Builders
Source: Compiled by the authors

These Huawei-related startups have successfully established connections with Taiwanese suppliers. Figure 3 illustrates the links between PXW, Pengxinxu, and L&K Engineering, demonstrating how L&K Engineering provided cleanroom construction services to Huawei's shadow network. The People's Government of Shenzhen first established SZMII, then launched IC manufacturers such as PXW and Pengxinxu, thereby forming Huawei's underground supply chain. The covert nature of these startups allows them to collaborate with subsidiaries of Taiwanese firms in China, potentially gaining access to materials, equipment, and services provided by Taiwanese companies.

Taiwan's First "T+A" Cleanroom Company in China

Brief introduction of the Taiwanese Cleanroom Builder

L&K Engineering's ascent is intimately connected to the growth of Taiwan's semiconductor industry and the progression of government industrial policies. This company was founded in 1978, initially focusing on mechatronic engineering and air conditioning projects. It later expanded into laboratory engineering, chemical and pharmaceutical plant projects, and cleanroom projects for the optoelectronics and semiconductor industries as Taiwan semiconductor industry began to thrive. In 2009, L&K Engineering acquired RSEA Engineering Corporation (榮民工程公司, RSEA), allowing its business scope to extend to civil construction. Passing the strict censorship of China Securities Regulatory Commission (中國證券監督管理委員會, CSRC) at the end of 2016, L&K Engineering along with its subsidiary in Suzhou became the first company that is both listed in Taiwan and China stock market.

Once L&K Engineering secured a strong foothold in the Chinese market, it successfully became a key supplier to major local wafer fabs. Today, L&K Engineering's business operations encompass a wide range of construction projects, including semiconductor fabrication facilities, biochemical plants, commercial buildings, and urban development. TSMC and UMC are among L&K Engineering's major customers, and the company also supports leading Chinese semiconductor firms such as SMIC, Fujian Jinhua, and YMTC. In 2023, the corporation reported consolidated revenues of NT\$56.9 billion, making L&K Engineering one of the largest cleanroom engineering companies in Taiwan.³³

³³ L&K Engineering [亞翔工程]. (2024). Consolidated financial statement 2023.

L&K Engineering's Development

| Time | L&K Engineering | Related Government Activities |
|-----------|---|---|
| 1978-2002 | <ul style="list-style-type: none"> ● 1978 established in Taipei ● 1996 first UMC cleanroom project | <p>The Taiwanese government</p> <ul style="list-style-type: none"> ● 1980 spun-off UMC, the first semiconductor manufacturer in Taiwan ● 1982 set Hsinchu Science and Industrial Park |
| 2002-2016 | <ul style="list-style-type: none"> ● 2002 set up the Chinese subsidiary L&K Engineering (Suzhou) ● 2008 started the equity carve out process ● 2009 acquired RSEA, the former state-owned civil construction company | <p>The Taiwanese government</p> <ul style="list-style-type: none"> ● 2000 the Chen Shui-Bian government: "active openness, effective management" ● 2006 the lawsuit against HeJian Technology and UMC ● 2008 the Ma Ying-Jeou government: strengthened economic ties with China |
| 2016- | <ul style="list-style-type: none"> ● 2016/12/30 the Suzhou subsidiary listed on SSE ● 2022/12/21 contract of UMC singapore branch | <p>The Chinese government</p> <ul style="list-style-type: none"> ● 2018 the Green Channel for unicorn companies ● 2023 tightened the review process <p>The Taiwanese government</p> <ul style="list-style-type: none"> ● 2024 Taiwan Chip-based Industrial Innovation Program (晶創計畫) |

Table 3: L&K Engineering's Development
Source: Compiled by the authors

L&K Engineering's Major Clients in Each Stage of Development

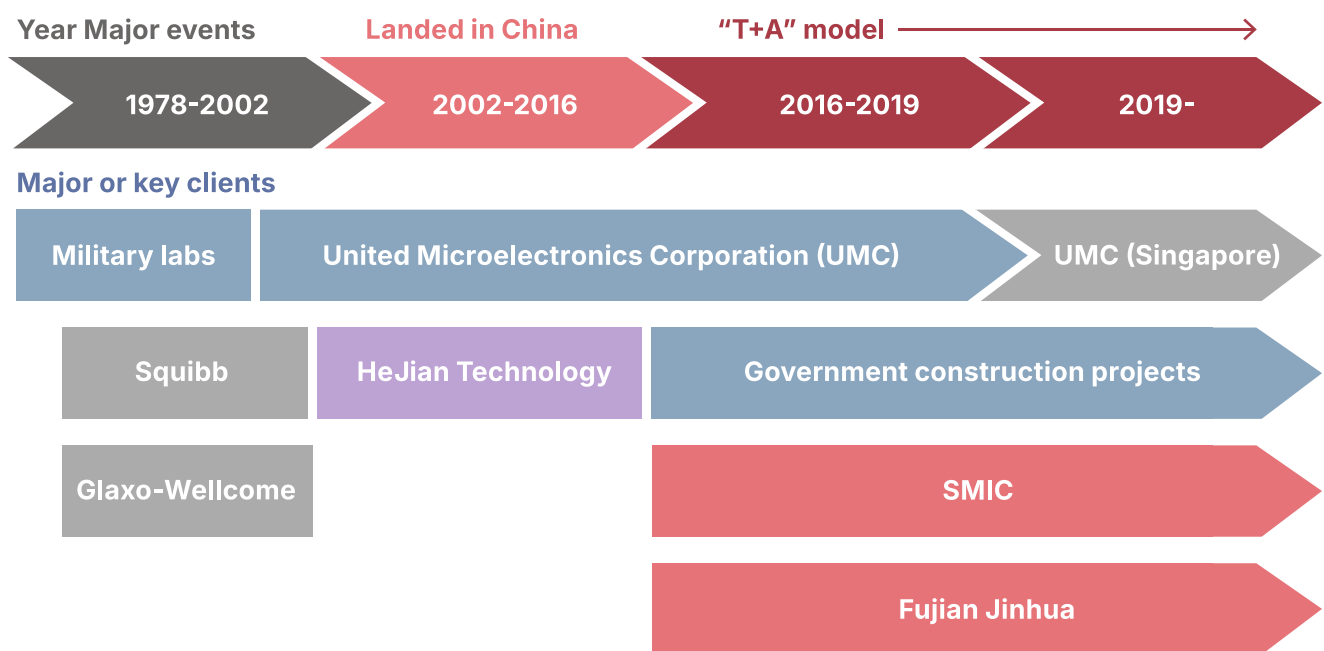


Figure 4: L&K Engineering's Major Clients in Each Stage of Development
Source: Compiled by the authors

● Chinese client
 ● Taiwanese company's subsidiary in China
● Client from other countries
 ● Taiwanese client

1978 – 2002: From Air Conditioning to Cleanroom

L&K Engineering and its founder, Yao Tsu-Shiang (姚祖驤), emerged during the optimistic atmosphere of the 1980s. At that time, Taiwan had survived the two oil crises of the 1970s, and the government had just decided that the mechanics and electronics industries would be the focus for the next decade.³⁴ After graduating from Shin-pu Institute of Technology (新埔工業專科學校), Yao worked at Dah Cheng Construction & Engineering Co., Ltd. (達正工程公司), an air conditioning engineering company. The opportunity that changed Yao's life soon arose: while working on a military-related project, Yao was encouraged by his customer, Mr. Lin (whose identity has not been revealed), to start his own company. Thus, L&K Engineering was established in 1978. In its early years, L&K primarily worked on military-related projects, such as the military laboratories and cleanrooms at the National Chung-Shan Institute of Science & Technology (國家中山科學研究院).³⁵

With the support of national industrial policies, L&K Engineering seized new development opportunities. In the 1980s, the Taiwanese government strongly promoted biotechnology and pharmaceutical manufacturing, attracting several foreign pharmaceutical corporations to establish factories in Taiwan. The GMP (Good Manufacturing Practice) policy, which required medicines to meet specific standards, significantly reshaped Taiwan's pharmaceutical manufacturing industry.³⁶ In this environment, L&K Engineering secured contracts for laboratories and clean rooms with the American pharmaceutical company Squibb in 1985 and the British company Glaxo-Wellcome in 1987. The experience gained from these collaborations provided crucial knowledge and expertise, enabling L&K Engineering to transform into a specialized clean room firm.³⁷ However, the reform of the pharmaceutical manufacturing industry slowed down as the GMP policy ended.³⁸

Concurrently, the semiconductor and electronics industries experienced rapid growth, prompting L&K Engineering to target the Hsinchu Science and Industrial Park as its new market. A pivotal deal was secured when L&K Engineering obtained contracts with UMC, which was the second-largest IC manufacturer in Taiwan and ranked among the top five globally as of 1996.³⁹ Over the last five years of the twentieth century, L&K Engineering

³⁴ Liang, M. Y., & Wang, W. Y. (2017). A Reflection on Taiwan's Rapid Economic Development Over the Past Half Century [台灣半世紀以來快速經濟發展的回顧與省思].

³⁵ Lin, Y. H. (2004, April 4). How L&K Engineering Became the Leader in the Cleanroom Industry [亞翔如何成為無塵室領域老大]. Business Today [今周刊].

³⁶ Cheng, C. Y., & Wang, C. H. (2009). Taiwan's Biotechnology and Pharmaceutical Industry: Development, Innovation, and Limitations [台灣的生技製藥產業：發展、創新與限制]. Taiwanese Journal of Sociology, 43, 159–208.

³⁷ L&K Engineering [亞翔工程]. (n.d.). About L&K.

³⁸ Lin Y. H. (2004, April 4). How L&K Engineering Became the Leader in the Cleanroom Industry [亞翔如何成為無塵室領域老大]. Business Today [今周刊].

³⁹ Smart Electronics Industry Project Promotion Office, IDA, MOEA [經濟部產業發展署智慧電子產業計畫推動辦公室]. (2023, July 17). 2022 World Revenue Ranking of Foundries [2022 年全球純晶圓代工廠商營收排名].

Lin, C. Y. (2024, June 12). The Latest Global Top 10 Foundries Ranking Released! TSMC Ranks 1st, SMIC Jumps to 3rd [全球前十大晶圓代工最新排名出爐！台積電第 1 中芯排名躍升至第 3]. United Daily News [聯合新聞網].

constructed five IC foundries for UMC. As the partnership with UMC solidified, L&K Engineering grew in the early twenty-first century to become one of Taiwan's leading cleanroom construction enterprises.⁴⁰

2002 — 2016: Landing in China

Continuing their partnership with UMC, L&K Engineering further expanded into the cross-strait semiconductor supply chain. Taiwanese businesses had long coveted China's vast market, abundant land, and cheap labor. To curb the transfer of advanced semiconductor technology to China, the Lee Teng-hui administration implemented the "no haste, be patient (戒急用忍)" policy. However, during the Chen Shui-bian administration, Taiwanese companies became even more eager to enter the Chinese market.⁴¹

Despite the Taiwanese government's cautious approach to business ventures in China, it could not ignore the global trend of China's integration into the international trade system. As international capital flooded into China, Taiwanese firms, including UMC and its long-standing partner L&K Engineering, were no exception. Both companies established a presence in China in 2001 and 2002, respectively. However, due to the different geo-political sensitivities associated with their positions in the supply chain, their investment outcomes in China have been vastly different.

UMC was widely suspected of being the actual owner of HeJian Technology (Suzhou) Co., Ltd. (和艦科技, HeJian), founded in 2001. This investment by a Taiwanese wafer foundry in China became one of the most emblematic cases of Taiwanese semiconductor companies expanding into the Chinese market at the time.⁴² To support HeJian in building its 8-inch wafer foundry, L&K Engineering subsequently established its Suzhou subsidiary in 2002.⁴³ Although restrictions on investing in China had been relaxed by then, investment in advanced chip manufacturing was still prohibited.⁴⁴ UMC's strategy blatantly disregarded existing restrictions on advanced chip manufacturing, highlighting a conflict between

⁴⁰ Lin Y. H. (2004, April 4). How L&K Engineering Became the Leader in the Cleanroom Industry [亞翔如何成為無塵室領域老大]. Business Today [今周刊].

⁴¹ Rigger, S. (2023). 從 MIT 到中國製造：臺灣如何推動中國經濟起飛 (馮奕達譯)。春山。(原著出版於 2021 年)

⁴² Lin, H. D. (2022, August 5). UMC's Robert Tsao Hit a Wall in China! Reflecting on the "HeJian Case" 21 Years Ago, He Regrets His Decision: "If I Could Do It Again, I Wish I Hadn't Set Up a Factory in China." [聯電曹興誠西進踢鐵板！21年前「和艦案」悔不當初：若能重來，我希望沒有到大陸設廠]. Wealth Magazine [財訊].

⁴³ Lin, W. C. (2017, April 12). L&K Engineering's New Listing Model: China's Market Value is Four Times That of Taiwan, Influencing the Relationship Between Taiwanese Companies and China's Capital Market [亞翔掛牌新模式 中國市值是台灣的 4 倍牽動台灣企業與中國資本市場新關係]. Wealth Magazine [財訊].

⁴⁴ Lin, H. D. (2020, February 5). 30 Years of Semiconductor Struggles Across the Strait - A Silent War [台商 30 年] 兩岸半導體纏鬥 30 年一場無聲的戰爭]. Wealth Magazine [財訊].

economic ambitions and regulatory compliance.

In 2006, the Taiwanese government launched an investigation. The president of HeJian, Hsu Jian-Hua (徐建華), was accused by prosecutors of being a "major economic criminal" and was barred from leaving Taiwan.⁴⁵ UMC's president and vice president, Robert Hsing-cheng Tsao (曹興誠) and Hsuan Ming-chih (宣明智), were sued for violating the Business Entity Accounting Law and committing breach of trust.⁴⁶ Although all charges were dropped in 2010, and the Ma Ying-jeou administration officially permitted UMC's investment in HeJian in 2012, the nine-year lawsuit underscored UMC's difficult entry into the Chinese market.⁴⁷

The Development of UMC and L&K Engineering in China

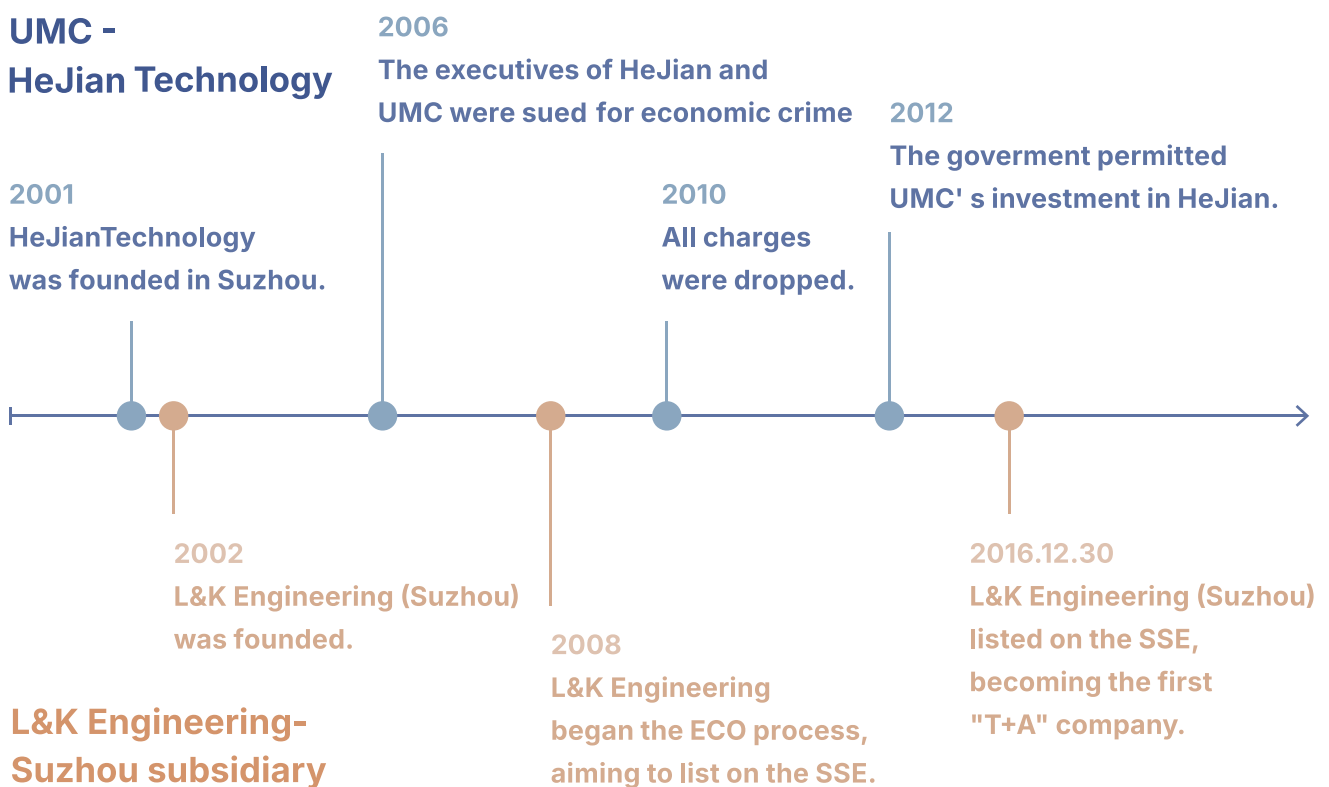


Figure 5: The Development of UMC and L&K Engineering in China

Source: Compiled by the authors

⁴⁵ Lin, W. C. (2015, February 25). UMC's Comeback: Robert Tsao Plots in Secrecy for 10 Years, Sending Assassin Xu Jianhua to Take on China. [聯電的逆襲：曹興誠蟄伏 10 年密謀 刺客徐建華進擊中國]. Wealth Magazine [財訊].

⁴⁶ The Liberty Times [自由時報]. (2011, April 23). News Dictionary: The Full Story of the HeJian Case [〈新聞辭典〉和艦案官司始末].

⁴⁷ Lin, H. D. (2022, August 5). UMC's Robert Tsao Hit a Wall in China! Reflecting on the "HeJian Case" 21 Years Ago, He Regrets His Decision: "If I Could Do It Again, I Wish I Hadn't Set Up a Factory in China." [聯電曹興誠西進踢鐵板！ 21 年前「和艦案」悔不當初：若能重來，我希望沒有到大陸設廠]. Wealth Magazine [財訊].

Divergent Development Paths of UMC and L&K Engineering Under Taiwan's Outbound Investment Review

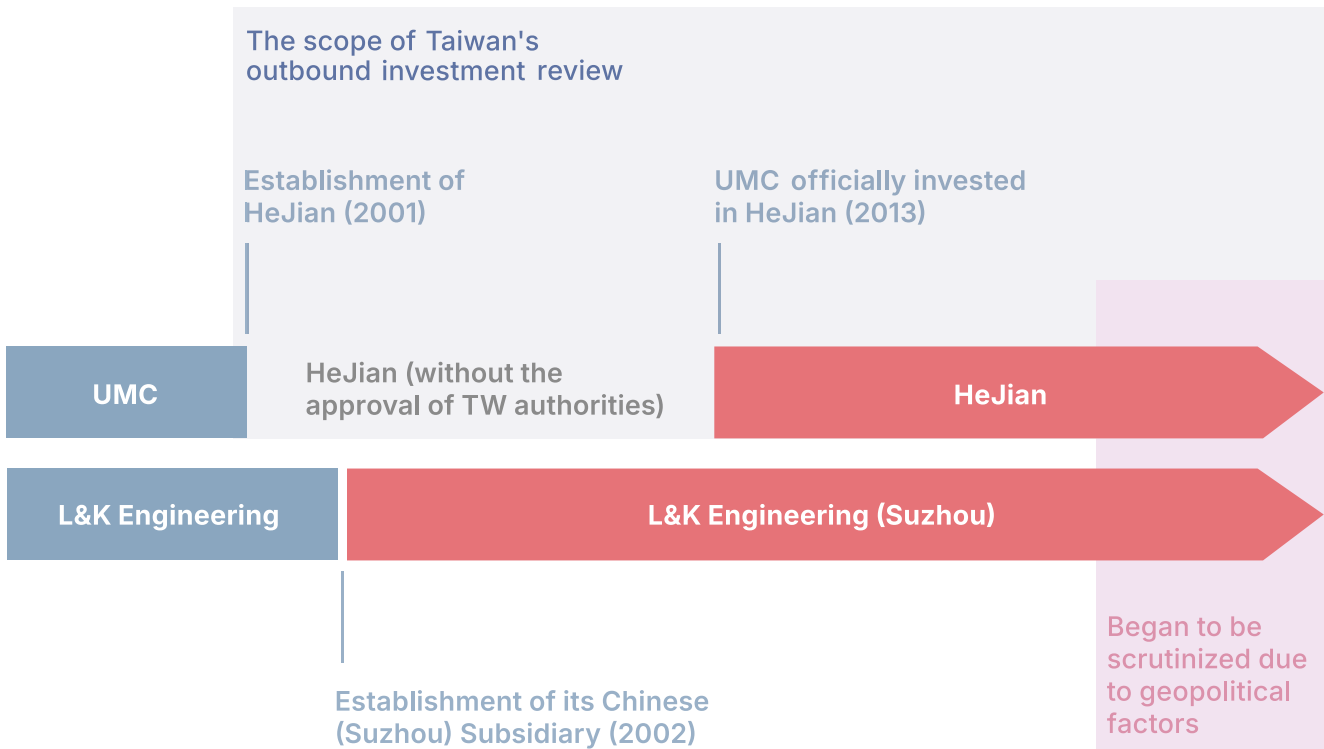


Figure 6: Divergent Development Paths of UMC and L&K Engineering Under Taiwan's Outbound Investment Review
Source: Compiled by the authors

In contrast, L&K Engineering (Suzhou) experienced relatively smooth development in China from 2002 to 2004, thanks to orders from HeJian.⁴⁸ It is worth noting that cleanroom construction—the company's primary business—has not been regarded as a core technology by the Taiwanese government. As a result, L&K Engineering (Suzhou)'s operations in China were less likely to attract government scrutiny.

L&K Engineering (Suzhou) entered the Chinese market at a time when the semiconductor industry was booming in China in the early 21st century.⁴⁹ During the same period, Taiwan's chip foundries had already completed their initial rapid expansion. To adapt, L&K Engineering primarily adopted two strategies. The first was to diversify its business scope in Taiwan.

⁴⁸ L&K Engineering (Suzhou) [亞翔集成]. (n.d.). Development history [發展歷程].

⁴⁹ Lin, H. D. (2020, February 5). 30 Years of Semiconductor Struggles Across the Strait - A Silent War [台商30年]兩岸半導體纏鬥30年一場無聲的戰爭]. Wealth Magazine [財訊].

In this regard, L&K Engineering continued the previous period's characteristic of closely following government-led policy demands by deciding to take over the privatization of a civil company with a military background, RSEA Engineering Corporation. Founded in 1956, RSEA was previously an enterprise under the Veterans Affairs Council (國軍退除役官兵輔導委員會), with a business scope covering public infrastructure such as governmental buildings, highways, and other transportation systems.⁵⁰ In 2009, L&K Engineering realized the privatization of RSEA by establishing a joint venture company with RSEA, retaining RSEA's old name, and taking over the civil engineering projects held by the former state-owned company.⁵¹ This move also allowed L&K Engineering to stabilize its acquisition of government engineering contracts.

The second major strategy in L&K Engineering's transformation was to strive for the Chinese market by going public. L&K Engineering (Suzhou) began an eight-year-long journey to list on the SSE. This process involved complex compliance work, requiring them to pass the strict regulations set by the CSRC.⁵² The ambitious move fully demonstrates Yao's emphasis not only on breaking into the Chinese cleanroom market but also on entering the capital market.

⁵⁰ LRSEA [榮工工程]. (n.d.). Company profile [公司簡介].

⁵¹ L&K Engineering [亞翔工程]. (n.d.). Development history [公司沿革].

⁵² Chiu, L. Y. (2017, March 28). L&K Engineering Pioneers the "T+A Model," Leveraging China to Attract Global Capital [亞翔首創「T+A 模式」借道中國搶全球資金]. Global Views Monthly [遠見雜誌]

L&K Engineering's Sources of Revenue, Sorted by Country (in Thousand NTD)

| Year | Revenue from Taiwanese Clients | Revenue from Chinese Clients | Revenue from other countries | Total |
|------|--------------------------------|------------------------------|------------------------------|------------|
| 2023 | 19,368,338 | 8,212,571 | 29,323,750 | 56,904,659 |
| 2022 | 22,792,634 | 11,133,520 | 1,812,732 | 35,738,886 |
| 2021 | 14,197,344 | 8,018,553 | 1,536,932 | 23,752,829 |
| 2020 | 9,859,087 | 3,674,773 | 382,702 | 13,916,562 |
| 2019 | 8,528,589 | 7,799,672 | 263,596 | 16,591,857 |
| 2018 | 11,399,281 | 10,565,068 | 270,727 | 22,235,076 |
| 2017 | 12,756,065 | 8,045,383 | 385,334 | 21,186,782 |
| 2016 | 12,199,380 | 10,770,359 | 503,644 | 23,473,383 |
| 2015 | 12,176,707 | 4,890,852 | 427,798 | 17,495,357 |
| 2014 | 11,658,101 | 2,581,661 | 259,937 | 14,499,699 |
| 2013 | 8,761,665 | 3,029,441 | 474,942 | 12,266,048 |
| 2012 | 9,074,625 | 3,278,611 | 259,757 | 12,612,993 |
| 2011 | 11,997,030 | 2,765,824 | 555,747 | 15,318,601 |
| 2010 | 6,092,164 | 2,257,011 | 625,694 | 8,974,869 |

Table 4: L&K Engineering's Sources of Revenue, Sorted by Country (in Thousand NTD)
The years of revenue from Chinese clients exceeding 1/3 of the total revenue are marked in red.
Source: L&K Engineering financial statements 2010-2023

The effects of these two transformation strategies are evident in the company's revenue data. Revenue from Taiwanese clients first surpassed 10 billion NTD in 2011, two years after the acquisition of RSEA. In contrast, during the same period, revenue from Chinese clients was stuck around 2 to 4 billion NTD. However, L&K Engineering's business in China boomed in 2016, following their successful listing, skyrocketing from 4.89 billion NTD to 10 billion NTD. Since then, revenue from Chinese clients remained almost as high as revenue from Taiwanese clients until the pandemic.

The First "T+A" Company and the Dual Capital Markets

What is the "T+A" model? Benefits and challenges

Before L&K Engineering (Suzhou) successfully listed in China, a Taiwanese company could not be listed on the SSE without meeting one condition: the Taiwanese parent company had to delist from the TWSE to have its Chinese subsidiary listed on the SSE. The case of Data Systems Consulting Co., Ltd. (鼎新電腦股份有限公司) illustrates this process, as it delisted from Taiwan to list on the Shenzhen Stock Exchange (深圳證券交易所, SZSE) as Digiwin Software Co., Ltd. (鼎捷軟件股份有限公司).⁵³

In contrast, L&K Engineering (Suzhou) adopted a different approach: the equity carve-out (ECO) process, which involved completely transferring certain valuable businesses from L&K Engineering to L&K Engineering (Suzhou).⁵⁴ China requires subsidiaries of Taiwanese companies to operate independently. Without delisting from Taiwan, L&K Engineering ensured that the operations and finances of the Taiwanese parent company and its Chinese subsidiary were managed separately, with no transfer of benefits or competition between the two entities.⁵⁵ Liu Fang-Jong (劉芳榮), Chairman of Fu-La-Kai Investment Bank (富拉凱投資銀行), pointed out that many Taiwanese businesses take orders and procure materials in Taiwan, then manufacture and sell their products in China, which fails to meet the requirement for business independence.⁵⁶ However, in the case of L&K Engineering, since cleanrooms are not typical products that can be easily imported or exported, there was little chance that the Taiwanese parent company would compete with the Chinese subsidiary in the Chinese market.⁵⁷ The only potential competition was in the Southeast Asia market. Eventually, L&K Engineering decided to let L&K Engineering (Suzhou) manage the cleanroom business in Southeast Asia, thereby meeting all the requirements for listing on the SSE.⁵⁸

After eight years of effort, the company successfully went public on the SSE on December

⁵³ Chiu, L. Y. (2017, March 28). L&K Engineering Pioneers the "T+A Model," Leveraging China to Attract Global Capital [[亞翔首創「T+A 模式」借道中國搶全球資金](#)]. Global Views Monthly [遠見雜誌].

⁵⁴ Chiu, L. Y. (2017, March 28). L&K Engineering Pioneers the "T+A Model," Leveraging China to Attract Global Capital [[亞翔首創「T+A 模式」借道中國搶全球資金](#)]. Global Views Monthly [遠見雜誌].

⁵⁵ Lu, P. H. (2017, March 1). China's Quiet Market Reforms Makes Taiwanese Businesses Reluctant to Go Home [[陸股低調改革 讓台商不回家](#)]. Common Wealth Magazine [天下雜誌].

⁵⁶ Lu, P. H. (2017, March 1). China's Quiet Market Reforms Makes Taiwanese Businesses Reluctant to Go Home [[陸股低調改革 讓台商不回家](#)]. Common Wealth Magazine [天下雜誌].

⁵⁷ Chiu, L. Y. (2017, March 28). L&K Engineering Pioneers the "T+A Model," Leveraging China to Attract Global Capital [[亞翔首創「T+A 模式」借道中國搶全球資金](#)]. Global Views Monthly [遠見雜誌].

⁵⁸ Chiu, L. Y. (2017, March 28). L&K Engineering Pioneers the "T+A Model," Leveraging China to Attract Global Capital [[亞翔首創「T+A 模式」借道中國搶全球資金](#)]. Global Views Monthly [遠見雜誌].

30, 2016. This made L&K Engineering the first "T+A" company, describing a company that is listed on both the TWSE and the SSE.⁵⁹ Joining the Chinese capital markets provides multiple benefits to Taiwanese firms. First, it enables the Chinese subsidiaries to raise local funds, reducing the financial burden on the Taiwanese parent companies. Additionally, being listed on the SSE enhances the credibility of the Chinese subsidiaries, thereby fostering their business growth in China. For instance, in a 2017 interview with CommonWealth Magazine, L&K Engineering's CFO Chen Shu-Chen (陳淑珍) mentioned that being publicly listed in China helps enhance the company's corporate credibility. Local governments and companies in China, concerned that foreign companies like L&K Engineering might abandon construction projects, did not trust them initially. After going public, L&K Engineering (Suzhou) found it easier to secure contracts from Chinese clients and obtain bank loan approvals. Furthermore, by offering stock to their Chinese employees, Taiwanese businesses can retain local talent and prevent them from being poached by other Chinese companies.⁶⁰

L&K Engineering's success also inspired other Taiwanese companies to enter the Chinese stock market. For example, Foxconn Technology Group (鴻海科技集團) listed its subsidiary, Foxconn Industrial Internet (工業富聯), on the SSE in June 2018. Similarly, Zhen Ding Tech Group (臻鼎科技集團) listed its subsidiary, Avary Holding (Shenzhen) Co., Ltd. (鵬鼎控股(深圳)股份有限公司), on the SZSE in September 2018.⁶¹

⁵⁹ Chiu, L. Y. (2017, March 28). L&K Engineering Pioneers the "T+A Model," Leveraging China to Attract Global Capital [亞翔首創「T+A 模式」借道中國搶全球資金]. Global Views Monthly [遠見雜誌].

⁶⁰ Lu, P. H. (2017, March 1). China's Quiet Market Reforms Makes Taiwanese Businesses Reluctant to Go Home [陸股低調改革讓台商不回家]. Common Wealth Magazine [天下雜誌].

⁶¹ Chiu, L. Y. (2022, February 9). Taiwanese Stocks Make a Grand Debut on A-Shares, Gaining More Than Just Capital in China's Financial Market [台股華麗躍上A股·闖進中國資本市場賺到的不只是資金]. Global Views Monthly [遠見雜誌].

The development of the "T+A" model

The success of L&K Engineering sparked a boom in the "T+A" model. Reviewing the recent development of this model reveals three primary phases, delineated by the years 2016 and 2023. Before 2016, the landscape consisted solely of "rootless" Taiwanese businesses. These companies were registered in Taiwan but had no actual business activities there, yet they listed on the Chinese stock market.⁶² This phase was characterized by Taiwanese firms seeking entry into the Chinese market without maintaining a substantial operational presence in Taiwan.

L&K Engineering's success initiated the second phase, which spanned from 2017 to the end of 2023. During this period, China's IPO review process was relaxed, accompanied by a series of policies aimed at attracting foreign investment.⁶³ This regulatory easing led to a significant increase in the number of "T+A" companies. By 2021, the number of companies carved out from Taiwanese parent companies for A-share IPOs had surpassed the number of "rootless" Taiwanese companies listed on the SSE.⁶⁴ A notable example is Zhen Ding Tech Group's subsidiary, Avary Holding, which raised RMB 3.6 billion through an A-share IPO.⁶⁵ Additionally, policies promoting inbound investment, such as the "Green Channel" policy introduced in 2018, further accelerated the proliferation of "T+A" companies. This policy lowered regulatory barriers, allowing large-scale technology startups in four emerging sectors—artificial intelligence, advanced manufacturing, biotechnology, and cloud computing—to apply for IPOs and receive immediate reviews. Foxconn's subsidiary, Foxconn Industrial Internet, successfully passed the IPO review in just 36 days through the Green Channel, exemplifying the benefits of these policy changes.⁶⁶

In August 2023, CSRC reversed its previous relaxation of the IPO review process, tightening regulations once again.⁶⁷ Consequently, the IPO applications from Taiwan for D.MAG New Material Technology Co., Ltd. (鼎鎂新材料科技股份有限公司) (parent company Giant Manufacturing Co., Ltd. 巨大集團) and Sunjuice Co., Ltd. (蘇州鮮活飲品公司) (parent company

⁶² Chen, T. J. (2018, May). Analyzing the Impact of Taiwanese Businesses Listing in Mainland China on Taiwan [[剖析臺商赴中國大陸上市對臺灣的影響](#)]. Economic Outlook Biomonthly [經濟前瞻], 177, 101-106.

⁶³ Chen, T. J. (2018, May). Analyzing the Impact of Taiwanese Businesses Listing in Mainland China on Taiwan [[剖析臺商赴中國大陸上市對臺灣的影響](#)]. Economic Outlook Biomonthly [經濟前瞻], 177, 101-106.

⁶⁴ Chiu, L. Y. (2022, February 9). Taiwanese Stocks Make a Grand Debut on A-Shares, Gaining More Than Just Capital in China's Financial Market [[台股華麗躍上A股，闖進中國資本市場賺到的不只是資金](#)]. Global Views Monthly [遠見雜誌].

⁶⁵ Chang, C. F. (2023, January 1). Observation: Taiwanese Companies Become More Active in Dual Listings Across the Strait, with PCB Manufacturers Being the Most Aggressive [[〈觀察〉台商兩岸雙掛牌籌資趨活躍 PCB廠最積極](#)]. Anue [鉅亨網].

⁶⁶ Hsieh, C. H. (2018, June 21). China's Unicorns Are Turning Out in Full Force [[中國獨角獸全面出動](#)]. Business Today [今周刊].

⁶⁷ Chang, C. F. (2024, February 17). Observation: Changes in the Capital Market Challenge Taiwanese Businesses' "T+A" Dual Listing Fundraising Model Across the Strait [[〈觀察〉資本市場生變 考驗台商「T+A」兩岸雙掛牌籌資模式](#)]. Anue [鉅亨網].

Sunjuice Holdings Co., Ltd. 鮮活控股, based in the Cayman Islands) were both rejected, leading to the suspension of their listing plans.⁶⁸ This regulatory shift introduced significant uncertainty into the Chinese capital market for Taiwanese companies seeking to list in China.

The impact was evident in the dramatic decline in IPO approvals. Compared to the third quarter of 2023, when seventy-two companies passed the SSE review, only thirty companies successfully listed on the SSE in the first quarter of 2024—a drop of more than half.⁶⁹ Additionally, eighty companies terminated their IPO plans altogether.⁷⁰ However, a noteworthy development occurred on June 11, 2024, when the SZSE, SSE, and Beijing Stock Exchange (北京證券交易所, BJSE) resumed their listing review meetings. These meetings focused primarily on industries at the forefront of U.S.-China technological competition, such as semiconductors and military industries.⁷¹ This resumption suggests that new opportunities may arise for specific Taiwanese companies within the Chinese capital market.

From L&K Engineering's perspective, even though the "T+A" model mandates the independence of subsidiaries, in this case, it's difficult to argue that the subsidiary is completely free from the parent company's control. Two key factors are the business operation and the ownership structure of the subsidiary. L&K Engineering's parent company primarily targets the Taiwan market, while its subsidiary, L&K Engineering (Suzhou), handles operations in China and Southeast Asia. Despite the geographical difference, their business models operations remain largely similar. As of the end of 2023, L&K Engineering still holds 53.99% of L&K Engineering (Suzhou)'s shares, making it the largest shareholder.⁷² Furthermore, seven out of the nine directors are members of L&K Engineering's Taiwan management team, with only two independent directors being Chinese nationals.⁷³

In 2017, the Chung-Hua Institution for Economic Research raised concerns that the "T+A" model might shift Taiwanese companies towards a more China-centric approach. The report highlighted three potential effects on Taiwanese firms and industries. First, China's

⁶⁸ Chang, C. F. (2024, March 6). Giant's Operational Outlook: D.MAG New Material Technology Halts Shanghai IPO, Temporarily Shattering the "T+A" Listing Dream [〈巨大營運展望〉鼎鎂新材料科技上海 IPO 案喊停 「T+A」雙掛牌夢暫難圓]. Anue [鉅亨網].

⁶⁹ GPLP. (2023, September 22). What Are the Approval, Rejection, and Withdrawal Rates for A-Share IPO Projects in 2023? [2023 年 A 股 IPO 項目過會率/被否率/撤回到底是多少?]. 36 Kr [36 氦].

⁷⁰ Huang, Y. H. (2024, April, 2). Strict Regulation on A-Shares! Only 30 Companies Listed in Q1, While 80 Terminated Their IPOs [A 股嚴監管! Q1 僅 30 家公司上市 多達 80 家公司終止 IPO]. United Daily

⁷¹ Huang, Y. H. (2024, June 11). China IPO Reviews Fully Resume: Most Applicants Are Semiconductor and Defense Companies [大陸 IPO 審核全面恢復 申請公司多為半導體、軍工類股]. United Daily News [聯合報].

⁷² L&K Engineering [亞翔工程]. (2024). Financial statements 2023.

⁷³ L&K Engineering [亞翔工程]. (2024, February 23). On behalf of L&K Engineering (Suzhou) Co., Ltd., Announcement of Board Changes at the First Extraordinary Shareholders' Meeting of 2024 [代子公司亞翔系統集成科技(蘇州)股份有限公司公告 2024 年第一次臨時股東會董事異動案]. Market Observation Post System [公開資訊觀測站].

IPO requirements, which necessitate carving out certain business operations to ensure the independence of Chinese subsidiaries, could lead to the transfer of advanced products or technologies to these subsidiaries. Second, the corporate restructuring involved in listing Chinese subsidiaries could create disputes over the ownership of the parent companies in Taiwan. Finally, China's strong push for foreign investment may cause Taiwanese companies to shift their strategic focus increasingly towards the Chinese market.⁷⁴ These three considerations are essential when monitoring L&K Engineering's long-term development and evolution.

L&K Engineering's Sources of Revenue, Sorted by Country (%)

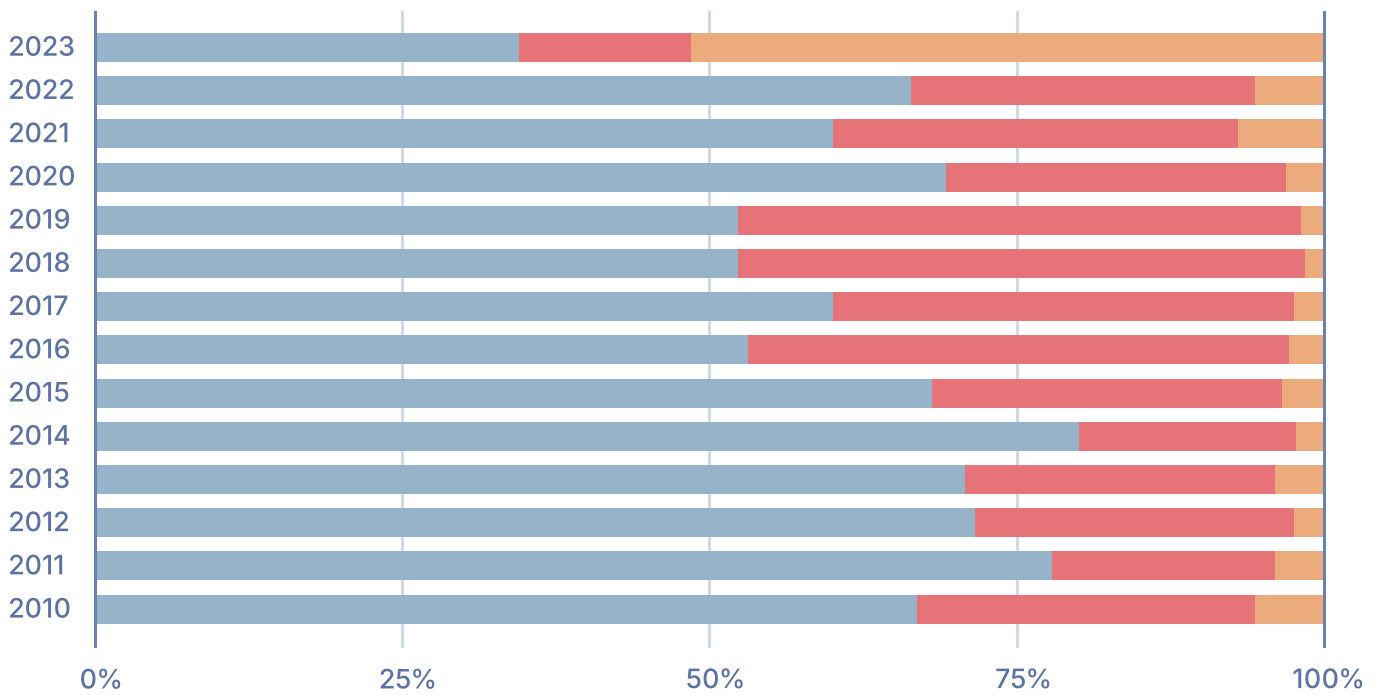


Figure 7: L&K Engineering's Sources of Revenue, Sorted by Country (%)
Source: L&K Engineering financial statements 2010-2023

● China ● Taiwan ● Other countries

⁷⁴ Chen, T. J. (2018, May). Analyzing the Impact of Taiwanese Businesses Listing in Mainland China on Taiwan [[剖析臺商赴中國大陸上市對臺灣的影響](#)]. Economic Outlook Bimonthly, 177, 101-106.

2016 – : Recent Development

On October 3rd, 2023, a Bloomberg article accused L&K Engineering, along with three other Taiwanese companies, of assisting Huawei-related firms in building fabs.⁷⁵ For L&K Engineering, this marked the first time in its 20-year business history in China to be scrutinized from a geopolitical perspective. In response to the accusations, L&K Engineering claimed that its subsidiary only provided basic engineering services, which were not directly related to advanced semiconductor production or other high-tech activities, to the Chinese companies.⁷⁶ According to L&K Engineering's 2023 annual report, the Huawei-related companies it has worked with are PXW and Pengxinxu. Both are state-owned chip manufacturers fully controlled by Shenzhen Major Industry Investment. L&K Engineering (Suzhou) has collaborated with PXW since March 2023 for the installation and material supply of its IC manufacturing line hookup project and with Pengxinxu since May 2023 for its integrated circuit production base cleanroom project.⁷⁷

However, it is undisputed that these Taiwanese companies have contributed to the rise of China's semiconductor industry. This issue not only concerns the advancement in China's technological competitiveness but also poses potential national security risks for Taiwan. Li Chung-Hsian (李忠憲), the professor of the Department of Electrical Engineering of National Cheng Kung University, points out that the chips produced by these factories, built with the assistance of Taiwanese companies, could ultimately be used in missiles aimed at Taiwan.⁷⁸

What the report did not mention is that L&K Engineering has been playing a significant role in the rapid advancement of China's semiconductor industry over the past decades. According to L&K Engineering's earnings calls, some of the most important targets of U.S. technological sanctions have been closely collaborating with L&K Engineering (Suzhou) since at least 2017.⁷⁹ There are ongoing projects with SMIC and Fujian Jinhua almost every year, varying in scale and technological level. Some projects involve renovation or expansion, while others include constructing entire plants, such as the memory building project for Fujian Jinhua in 2017. Additionally, the sanctioned firm Yangtze Memory Technology Corp. (長江存儲科技有限責任公司) had L&K Engineering (Suzhou) build its Fab2 in the National Memory Base Project

⁷⁵ Bloomberg. (2023, October 3). [Taiwan tech companies are helping Huawei build a secret network of chip plants.](#)

⁷⁶ L&K Engineering [亞翔工程]. (2023, October 4). Clarification of media reports [澄清媒體報導]. Market Observation Post System [公開資訊觀測站].

⁷⁷ L&K Engineering [亞翔工程]. (2024 June). 2023 annual report.

⁷⁸ Central News Agency [中央社]. (2023, October 3). Bloomberg: Taiwan's Topco, UIS, and 4 Other Tech Companies Assist Huawei in Establishing Chip Factories [彭博:台灣崇越漢唐等4科技公司協助華為設晶片廠].

⁷⁹ L&K Engineering [亞翔工程]. (2017-2024). Handbooks for the Annual Meetings of Shareholders 2017-2024.

in 2020 and 2022, which is directly funded by the Chinese government to develop world-leading memory technology.⁸⁰ Moreover, Huawei itself has been a client of L&K Engineering (Suzhou). In 2019, L&K Engineering helped Huawei build its data center in Suzhou and the Songshan Lake R&D Base in Dongguan. The former project involved electrical and sanitary engineering, while the latter project only included precision molding.⁸¹

The China market has accounted for a large share of L&K Engineering's revenue since 2016. In that year, revenue from Chinese clients surpassed one-third of the total revenue for the first time. This trend continued over the next three years, with the China market contributing nearly the same share of revenue as the Taiwan market. However, the pandemic in 2019, along with the large-scale lockdown imposed by the Chinese government, caused revenue from Chinese clients to plummet from 7.8 billion NTD in 2019 to 3.67 billion NTD in 2020, while revenue from Taiwanese clients grew from 8.53 billion NTD to 9.86 billion NTD. After the pandemic, revenue from Taiwanese clients and L&K Engineering's total revenue rose to an all-time high as the Taiwan semiconductor industry grew rapidly.

Moreover, the expansion of UMC in Singapore has brought significant profits to L&K Engineering since 2022. UMC has shifted its focus from China to Singapore by building Fab 12i, which will be dedicated to 22/28 nm IC manufacturing after 2026.⁸² Leading the EPC project for Fab 12i, L&K Engineering's revenue from the "other countries" category surged to 29.32 billion NTD, accounting for 51.53% of the total revenue in 2023. This clearly reflects the growth of its Southeast Asia operations.

Although L&K Engineering's business focus seems to be shifting to Southeast Asia with UMC, there are two important points to note. First, the Southeast Asia market is managed by L&K Engineering (Suzhou). To meet the SSE listing requirements, L&K Engineering decided to transfer the Southeast Asia market to its Chinese subsidiary. As a result, the UMC Fab 12i EPC project in Singapore is conducted by L&K Engineering (Suzhou) with the assistance of L&K Engineering's branch in Singapore, and the revenue earned in Singapore is shared between the Chinese subsidiary and the Singaporean branch.⁸³ Second, while the distribution of the China market may appear to shrink in percentage terms due to

⁸⁰ TechNews [科技新報]. (2017, January 17). China's Memory National Team Boldly Claims: We Will Catch Up to World-Class Manufacturers by 2020 [中國記憶體國家隊豪言：2020年追上世界級大廠].

⁸¹ L&K Engineering [亞翔工程]. (2019). Handbook for the Annual Meetings of Shareholders 2019.

⁸² Chou, K. W. (2024, May 26). UMC's New Factory Expansion in Singapore Set to Begin Production in 2026; Analysts Estimate EPS of 4.3 NT\$ This Year [聯電新加坡擴建新廠 2026年投產 法人估今年EPS 4.3元]. United Daily News [聯合報].

⁸³ Atkinson. (2022, December 21). UMC Invests NT\$ 13.387 Billion to Lease Land for the Construction of the Fab 12i P3 Facility in Singapore [聯電斥資 133.87 億元，以租地委建逾新加坡興建 Fab 12i P3 廠房]. TechNews [科技新報].

L&K Engineering's Sources of Revenue, Sorted by Country (in Billion NTD)

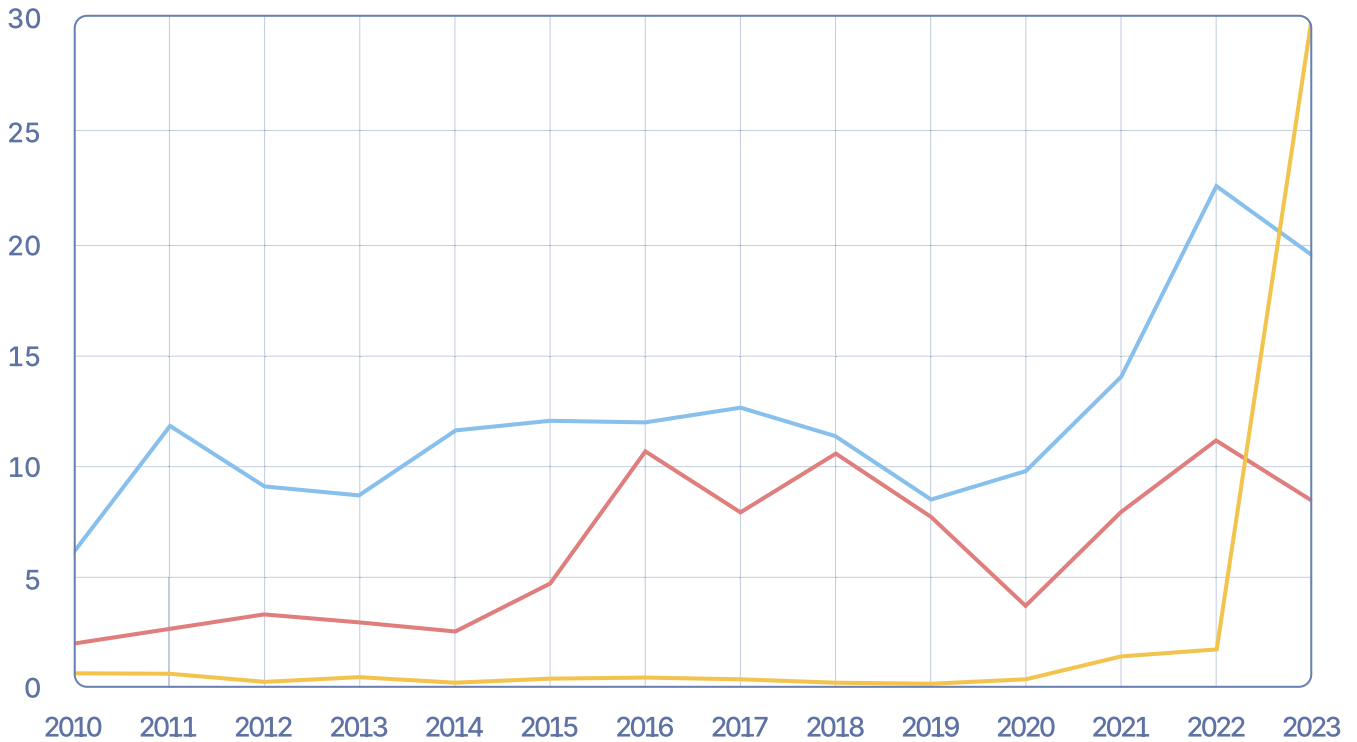


Figure 8: L&K Engineering's Sources of Revenue, Sorted by Country (in Billion NTD) ● China ● Taiwan ● Other countries
Source: L&K Engineering financial statements 2010-2023

significant revenue from the UMC Singapore foundry, the actual revenue from Chinese clients quickly bounced back to pre-pandemic levels. From 2016 to 2019, revenue from Chinese clients ranged between 7.8 billion to 10.77 billion NTD. Although it dropped to 3.67 billion NTD in 2020, it recovered to 8.02 billion NTD just one year after the pandemic and has remained above 8 billion NTD since then. In 2022, it reached an all-time high of 11.13 billion NTD. Moreover, in 2023, L&K Engineering (Suzhou) still holds contracts with its major Chinese clients, SMIC and Fujian Jinhua.⁸⁴ While revenue from Chinese clients is diluted by the considerable revenue from the UMC Singapore foundry, this does not mean that the contribution of the China market is no longer important. On the contrary, L&K Engineering (Suzhou) may continue to obtain new growth opportunities through revenue streams from both China and Southeast Asia. For a semiconductor company like L&K Engineering, which originated and developed its technology in Taiwan, the effects of the "T+A" model have caused the company's business growth to be reflected in the accounts of its Chinese subsidiary rather than in its Taiwanese parent company.

⁸⁴ L&K Engineering [亞翔工程]. (2024, June). Annual Report 2023.

Implications for Taiwan's Economic Security

Taiwanese Semiconductor Technology Integrated into Shenzhen's "Third Pole" Strategy

To achieve self-sufficiency, the Chinese government heavily subsidizes its semiconductor industry through institutions such as the ICF, investing billions of RMB annually. SZMII, an investment corporation fully owned by the People's Government of Shenzhen Municipality, plays a crucial role in distributing resources and building Huawei's underground supply chain. Through three main approaches, SZMII attracts well-established IC manufacturers like SMIC to build fabs in Shenzhen, further nationalizes existing semiconductor companies, and establishes numerous covert firms dedicated to various positions within the semiconductor supply chain.

These industrial policies are clearly aimed at countering U.S. sanctions. Huawei, as China's champion enterprise, frequently introduces new technological advancements that raise international skepticism about the effectiveness of export controls. For example, Huawei continues to launch high-end cell phones equipped with advanced chips fabricated by Chinese IC firms. Currently, Huawei's shadow network has entered the realm of international policy discussions. Building on this issue, the policy report primarily addresses two significant extended discussions: first, how does the Shenzhen model operate under China's semiconductor industry policies? Second, what is the collaborative relationship between the Shenzhen model and Huawei, the Chinese champion enterprise, and more importantly, the collaborative relationship between the Shenzhen model, Huawei, and Taiwanese semiconductor firms?

SZMII exemplifies how Chinese regional governments pursue their own interests while coordinating with the central government. Following the establishment of mature semiconductor clusters in Shanghai and Beijing, the Shenzhen municipal government aims to position Shenzhen as "the third pole" of China's advanced semiconductor industry. This indicates that even under the central government's overarching policy to develop technological self-sufficiency, competition among local governments within China persists. Local governments may possess more comprehensive local industry information, enabling

them to make informed policy decisions that drive their own industrial development agendas. Consequently, within China, at least three semiconductor industry ecosystems could develop—Shanghai, Beijing, and Shenzhen—each with its own development focus while maintaining a certain degree of industry chain completeness. Instead of operating as a single entity, the competition and interaction among these local governments will be crucial for observing the technological development and breakthroughs of China's semiconductor industry, as well as the effectiveness of international export control regimes.

Furthermore, the Shenzhen municipal government's pursuit of a complete semiconductor industry chain involves both support for Huawei's shadow network and the attraction of "foreign" capital and technology. On one hand, it assists Huawei in developing and managing its shadow network in Shenzhen, which includes SZMII-backed chip manufacturers, including PXW, Pengxinxu and SwaySure. On the other hand, the Shenzhen municipal government attracts "foreign" capital and technology, including SMIC's investment in Shenzhen for wafer manufacturing and Taiwan's L&K Engineering, which assists these wafer fabs with cleanroom engineering. Consequently, capital and technology related to Taiwan's semiconductor industry are integrated into China's current semiconductor sector, particularly within Shenzhen's development strategy as "the third pole" of the industry.

Strengthening Regulatory Measures and Addressing Complicating Factors

Taiwan's investment review mechanisms for investments in China were established over thirty years earlier than the current policy discussions initiated by the United States and Europe. The investment processes of Taiwan's major wafer manufacturers entering China have always been subject to scrutiny and review by Taiwanese authorities. For example, UMC engaged in nearly a decade-long legal battle with Taiwanese officials before confirming the legality of establishing its Chinese subsidiary as Taiwan's second-largest wafer manufacturer. However, L&K Engineering, which benefited from UMC's orders and jointly set up factories in China, did not receive the same level of scrutiny and attention. Instead, L&K Engineering continued to expand in the Chinese market by serving major semiconductor companies such as SMIC, Fujian Jinhua, and even Huawei and its shadow network, thereby thriving in the Chinese market despite the ongoing U.S.-China technological rivalry.

The crucial difference lies in the fact that UMC's wafer manufacturing technology is considered a core technology subject to strategic management measures by the Taiwanese government, whereas L&K Engineering's cleanroom engineering and other related project engineering services for wafer manufacturers fall outside regulated areas. This disparity in regulatory intensity is understandable. However, it does not negate the fact that Taiwanese semiconductor companies have assisted Huawei in developing a more comprehensive semiconductor manufacturing supply chain. This collaborative relationship may accelerate China's technological self-sufficiency, thereby threatening international economic security systems and even Taiwan's national security. As highlighted by the scholar in Taiwan's technology sector, as China's self-sufficiency in chip technology increases, there is a risk that these technologies could be used in China's military-industrial complex, posing a threat to Taiwan's security.

The Taiwanese government is not without viable means to enhance regulatory oversight. Particularly in the case of L&K Engineering, the company's growth trajectory is closely linked to Taiwan's official industrial policies, and it has undertaken numerous publicly released government infrastructure projects. These public-private sector collaborations could serve as leverage for the Taiwanese government to implement supply chain management, given that private sector companies are not entirely insulated from the industry resources dominated by the public sector. However, relying solely on the Taiwanese government to enforce supply chain controls may not be effective. Given the complexity of the

global semiconductor supply chain, any regulatory measures, even if necessary, must carefully address the following issues: whether Chinese domestic companies can achieve technological self-sufficiency and eliminate dependence on foreign technologies without Taiwanese firms' contributions, and whether other countries' companies might inadvertently replace Taiwanese firms. Consequently, Taiwan must depend on multilateral frameworks with like-minded countries to further enhance international economic security cooperation.

A more challenging variable in the case of L&K Engineering is the operation of the "T+A" model. To some extent, although L&K Engineering remains a Taiwanese company with technology originating in Taiwan and its Chinese subsidiary still primarily controlled by the Taiwanese parent company, the Chinese subsidiary's listing in China, completion of local compliance reviews, and acquisition of development opportunities in both the Chinese and Southeast Asian markets have achieved a certain degree of localization. If the Chinese subsidiary is no longer viewed merely as an extension of the Taiwanese parent company but instead as a more independent entity, or if L&K Engineering in Taiwan and other industry chains in like-minded countries lack opportunities for diversified development, it may become increasingly difficult to prevent L&K Engineering's Chinese subsidiary from leaning further towards the Chinese market in the future.

Under current circumstances, the Taiwanese government and the international community face the challenge of implementing economic security measures and guiding semiconductor companies outside of China to adapt to emerging geopolitical conditions. This must be done without allowing these companies to become excessively and continuously integrated into China's semiconductor industry strategy.

Appendix

L&K Engineering's ongoing projects every year sorted by corporation

Only SMIC, Fujian Jinhua, Yangtze Memory, Changxin Memory, and Huawei are listed.

Source: Handbooks for the 2017-2024 Annual Meetings of Shareholders

| Corporation | BIS Entity List | Year | Project |
|-------------|-----------------|------|--|
| SMIC | Listed | 2017 | Semiconductor Manufacturing International Corporation -F FAB7 MAU Renovation Project |
| | | 2018 | SMIC Integrated Circuit Manufacturing (ShangHai) Co., Ltd. -2018 SMIC South China Fab8 P2 Phase I - CU.S. Procurement and installation |
| | | 2019 | Semiconductor Manufacturing International Corporation -Tianjin Zhongxin Tiandome Expansion Project Power Engineering |
| | | | SMIC integrated circuit manufacturing (ShangHai) Co., Ltd. -2019 Fab8 P2 Power Phase II-System Expansion PCW/PV/HV |
| | | 2020 | Semiconductor Manufacturing International Corporation (Tianjin) -Fab7 P2 Phase II Tianxiang Facility Engineering - Manufacturing Cooling Water System Engineering, Central Power System |
| | | | Semiconductor Manufacturing South China Corporation -2020 South Phase IV Facility Engineering - CU.S./PCW&PV System Expansion Project |
| | | 2021 | Semiconductor Manufacturing International (Shanghai) Corporation -2021 SH Fab1 Dengfeng Project Phase II Power Expansion Project |
| | | | Semiconductor Manufacturing International (Shanghai) Corporation -SH Fab1 Dengfeng Project Phase I Project CR Part Expansion Power Part Expansion |

| Corporation | BIS Entity List | Year | Project |
|-------------|--|----------------|--|
| SMIC | Listed | 2021 | Semiconductor Manufacturing International (Shenzhen) Corporation -2021 SZ Fab6 Qianhai Project Factory Power Equipment Installation Expansion Project |
| | | | Semiconductor Manufacturing International (Tianjin) Corporation -Fab7 P3 CU.S. Project/PCW Project |
| | | | Semiconductor Manufacturing North China (Beijing) Co., Ltd. -2020 BJ Fab2 P2 Hengshan Project Factory Power System Installation Expansion Project 2020 BJ Fab2 P2 Yanshan Project Factory Power System Equipment Installation Expansion Project |
| | | | SMIC Jingcheng Integrated Circuit Manufacturing (Beijing) Co., Ltd. -Fab3 P1 PCW/PV/HV Project |
| | | 2022 | Semiconductor Manufacturing International (ShenZhen) Corporation -2021 SZ FAB 6 -XiangmihuProject -EXH System Expansion Project |
| | | | Semiconductor Manufacturing South China Corporation -2022 SH Fab8-P2 Expansion Project (P1) Factory Renovation and Expansion Project - General Electromechanical System Engineering of Clean Room, Power System Engineering, PCW-PV-HV System Engineering |
| | | | SMIC integrated circuit manufacturing (Beijing) Co., Ltd. -2021 BJ Fab2-P1 Risk Improvement - High Dry Variable Load Improvement Project, VCB Replacement Project |
| | | | SMIC JingchengIntegrated Circuit Manufacturing (Beijing) Co., Ltd. -2021 BJ Fab3 P1 Plant Construction Project Cooling Water Process Vacuum and Vacuum Cleaning System Engineering |
| | | 2024 | SMIC JingchengIntegrated Circuit Manufacturing (Beijing) Co., Ltd -2023 BJ Fab3 P1 Electrical System Expansion |
| | | Fujian Jinghua | Listed |
| 2019 | JHICC 20K HOOKUP-ELEC/HVAC/WW | | |
| 2022 | JHICC 20K HOOKUP-ELEC/HVAC/WW | | |
| 2023 | JHICC 20K HOOKUP-ELEC/HVAC/WW | | |
| | Electromechanical Water Hook Up Project | | |
| 2024 | Hook UP (Power·PV·Drain·Exhaust·Interior·PCW&LSW·UPW&ROR·NaturalGas) / P1 ELEC and HVAC Expansion (HVAC Package A) | | |

| Corporation | BIS Entity List | Year | Project |
|--|-----------------|------|---|
| Yangtze Memory | Listed | 2018 | Changjiang Storage Technology Co., Ltd. -The national memory base project-phase 1 installation of general distribution and purchase (FAB1) equipment |
| | | | Wuhan Xinxin Semiconductor Manufacturing Co., Ltd. -12' IC Phase II CR Project |
| | | 2019 | Wuhan Xinxin Semiconductor anufacturing Co.,Ltd. -Wuhan Xinxin National Memory Base Project (Phase I) Stage II Project Gasification Pipeline Project (VMB / VMP Expansion Project) |
| | | | Changjiang Storage Technology Co., Ltd. -Wuhan Xinxin Semiconductor Manufacturing Corporation General Distribution Package P1-2 |
| | | 2020 | Yangtze Memory Technologies Co., Ltd. -National Memory Base Engineering (Phase I) Phase II Engineering Project Gasification Pipeline Engineering Construction Project |
| | | 2022 | Yangtze Memory Technologies Co., Ltd. -National Memory Base Project (Phase I) FAB 2 & Building/ MEP - EPC Project |
| Yangtze Memory Technologies Co., Ltd. -FAB 2 -Process Piping Installation Project (Package A) | | | |
| Changxin Memory | Not included | 2018 | Hefei Changxin Integrated Circuit Co., Ltd. -12 " memory wafer manufacturing base H03 process system package |
| | | 2019 | Innotron Memory Co., Ltd. -Hefei Changxin 12" Wafer CP Production Process Machine Installation and Secondary Metering Project |
| | | 2020 | Innotron Integrated Circuits Co., Ltd. -40K Power System Expansion Project &Y2020BP Power Station Expansion Project |
| | | 2021 | INNOTRON MEMORY CO.,LTD. -National Memory Base Project (Phase I) FAB 2 & Building/ MEP - EPC Project |
| | | 2022 | ChangXin Memory Technologies,Inc -12-inch Memory wafer Manufacturing Base Phase II Project Clean Room Package B |
| | | | ChangXinMemory Technologies, Inc. -FAB A2B Clean Room Project |
| Huawei | Listed | 2019 | HUAWEI digital technology (Suzhou) Co., Ltd. -Suzhou HCIE Data Center Electromechanical contract Package II (Electrical, Plumbing and Sanitary and steel platform) |

| Corporation | BIS Entity List | Year | Project |
|-------------|-----------------|------|--|
| Huawei | Listed | 2019 | HUAWEI Investment & Holding Co., Ltd. -LG19111 Songshan Lake C11 precision mold project |
| | | 2020 | Huawei Investment & Holdings Co., Ltd. -Dongguan Huawei LG19233 Songshan Lake C11 Precision Mold Project |



Research Institute for **Democracy,**
Society, and **Emerging Technology**

Economic Security