Semiconductors Global Policy Review

September 2021

Access Partnership

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Semiconductors are *the* quintessential American invention.

Invented at Bell Labs in New Jersey, perfected in three coastal states, and fabricated *en masse* in places as different as upstate New York, Oregon, and Arizona. Alumni from semiconductor industry's early talent pool seeded rapidly scaling new industries including video games (Atari), consumer electronics (Apple), software (Adobe), and aerospace/defense (Lockheed). Semiconductors literally put the "silicon" in "Silicon Valley."

While still *quintessentially* American, no longer are chips solely American.

Much of the world's logic processing is licensed from Arm, a British chip design firm owned by Japan's Softbank. China imports over USD 350 billion worth of semiconductors annually (more than crude oil). South Korea's Samsung and Taiwan's TSMC together account for nearly 75% of the world's global foundry market share.

Governments are sitting up and taking notice. What was global is now geopolitical, and not for the first time.

America accused Japan of "dumping" semiconductors in the late 1980s sparking a trade war. The US responded by creating SEMATECH an R&D consortium, scuttling Fujitsu's acquisition of Fairchild Semiconductor, and enacting the Exon-Florio Amendment establishing the Committee on Foreign Investment in the United States (CFIUS).

History rhymes. Instead of a surplus, today the world faces a semiconductor shortage. While the US weighs whether to invest more than USD 50 billion of public money expanding US domestic foundry capacity, China will spend over USD 150 billion subsidizing its own domestic industry. Meanwhile, new export controls for "emerging" and "foundational" technologies are matriculating from the US to Wassenaar Arrangement members. And the EU is setting aside significant Horizon Europe state aid for its microelectronics base.

Now more than ever semiconductor ecosystem players—integrated or fabless, foundries or capital equipment companies, and especially semiconductor consumers—need wise and experienced counsel.

Access Partnership provides our clients deep understanding of the macro geopolitical environment at the strategic level while driving outcomes on the ground through relationships and targeted engagement with decision makers. Not just in Washington, but internationally and locally—from Beijing to Boston and Singapore to Sacramento.

Because our mission of Fair Tech starts at the chip-level.

Executive Summary

- **Massive funneling of government funding into building out domestic semiconductor capabilities.** The US has proposed over USD 50 billion in semiconductor manufacturing incentives, while the European Union has allocated nearly USD 63 billion of its Horizon Europe budget to boost industrial competitiveness in technologies such as semiconductors and China has funneled over USD 150 billion into developing its semiconductor industry.

- **Primary focus on not just securing domestic critical supply chains but more broadly striving for larger shares of global semiconductor output.** The European Union has set a goal of producing 20% of the world's cutting-edge semiconductors and China is targeting to domestically produce 80% of China's semiconductor production and have global leading capabilities across the semiconductor value chain by 2030.

- **Increased politician awareness and discussion of semiconductor-related issues.** Tweets from US Congressional members about semiconductors have increased by 138% since 2020, while there is a 92% increase for European Parliament members and a 300% increase for European national parliament members.

- **Increased weaponization** of semiconductor and dual use export controls to cripple adversaries' domestic semiconductor industries.

- **Continued bifurcation of US and Chinese** semiconductor value and product chains, cutting the US and China (and potentially their allies) off from key dependencies such as critical material inputs and advanced chip designs.

- **Increased scrutiny of intellectual property** and technology transfers from the US and US allies to China, including Chinese acquisitions of foreign semiconductor companies.

Key Regional Take-Aways

United States

- Proposed one-in-a-generation funding for domestic semiconductor R&D and manufacturing presents potential opportunities for companies.
- Final approval of incentives is not guaranteed as Congress disagrees on the correct approach to establish US technological competitiveness.
- Companies may face additional scrutiny or restrictions on their business as the Biden administration weighs tightening export controls on the transfer of semiconductor technologies to competitors such as China.

Europe

- Initiatives with billions of dollars in funding to build regional technological capabilities provide new opportunities for private sector R&D and public-private collaboration in semiconductor manufacturing.
- Non-European companies may face barriers to market access in Europe with increasing political desire to reduce reliance on non-European technologies and build regional and domestic supply chain.

China

- Continued government subsidization of a domestic semiconductor industry presents substantial opportunities for both domestic companies and foreign ones with operations in China.
- Foreign companies may be subject to strict market access requirements that could be unfavorable or open them up to scrutiny from home country governments.

Northeast Asia

- Continued importance as the global powerhouse of major semiconductor manufacturing facilities and capabilities.
- Continued bifurcation between industry leaders and governments' approaches to China, which is a major consumer market but represents significant geopolitical risk.
- Increasing political desire and emphasis on re-shoring or near-shoring supply chains, localizing R&D, and emphasizing economic securitization.

Southeast Asia

- Continued importance as a logistics hub for the movement of semiconductor products across the world.
- Increasingly an important assembly, testing, and packaging hub as companies move their operations from China to nearby locations with favorable tax and market access policies, as well as lower geopolitical risk.
- Some countries are starting to implement policies to attract high-value semiconductor business focusing on R&D and design, presenting further opportunities for multinational companies.

What is a semiconductor and how is it made?

Semiconductors are critical to the modern and digital economy not only because they are a key building block in all electronic devices, but also because they enable new products, services, and industries. For example, semiconductors facilitate emerging technologies such as **artificial intelligence, autonomous systems, 5G communications, and quantum computing.** It is estimated that semiconductors enabled innovations that have created at least **USD 3 trillion in GDP** over the last 20 years.

1

Research & Development

Scientists innovate design and manufacturing technologies to advance the leading edge of semiconductor technology. This step also includes the innovation of fundamental materials and chemical processes needed to develop semiconductors.

2

Design

Design firms, such as fabless companies, develop integrated circuits that perform functions like computing, storage, and connectivity to enable the more complex functions of electronic devices.

3

Fabrication

Foundries or "fabs" print integrated circuits onto wafers. Each wafer contains multiple chips, with the number varying from hundreds to hundreds of thousands depending on the function and size of the chip.

4

Assembly, Testing, and Packaging

Firms compile wafers into finished semiconductor products. Wafers are sliced into individual chips, packaged, and tested. They are then distributed to electronic device manufacturers.

Chip Industry Choke Points

The highly specialized nature of the semiconductor input and manufacturing process lends itself to a compartmentalized global supply chain. Regions have their own expertise in a different part of the semiconductor production ecosystem.

Source: Company Quarterly and Year-End Filings, Bloomberg Data
Note: Samsung revenue is for its semiconductor segment.

How did we get here?

1994 (WSC)
Global Semiconductor Alliance (GSA) established.

1996 (WTO)
World Semiconductor Council (WSC) established.

1996 (WTO)
Wassenaar Arrangement established to foster support for export controls on agreed-upon dual use technologies including semiconductors.

1997
WTO Information Technology Agreement (ITA) to eliminate duties on IT products enacted.

1998 (GSA)
WSC members develop the first International Technology Roadmap for Semiconductors (ITRS).

2005
WSC regions eliminate tariffs on Multi-Chip Package ICs (MCPs).

2015
WTO ITA updated to include advanced semiconductors (ITA II).

2020
Member states add military grade software and manufacturing technology for weapons-capable chips to the Wassenaar list.

Why is this now an issue?

The semiconductor supply chain has increasingly come under scrutiny after several black swan events that have restricted manufacturing and crippled global trade, leading to a significant and ongoing semiconductor shortage.

- Rising US-China geopolitical tensions
- Severe weather events, such as US ice storms and Taiwan's drought
- Outbreak of COVID-19 pandemic
- Unforeseeable events, such as multiple factory and manufacturing plant fires in Japan
- Decreasing number of companies with leading-edge semiconductor manufacturing capabilities

This shortage is likely to continue causing global supply chain constraints into 2022 and 2023. These events have led to a global debate about the benefits of diversifying supply chains and re-shoring key manufacturing. As a part of these debates, countries around the world have started to more rigorously scrutinize the security of their critical supply chains and invest in domestic research and development, design, fabrication, and ATP of semiconductors.

How does this shortage impact you?

- 60-week delay on production of internet routers.
- New PlayStation, Nintendo, and Xbox consoles are in short supply, causing surging re-sale prices.
- Samsung cancelled the release of the 2021 Galaxy Note phone.
- Apple delayed the release of the iPhone 12.
- Ford and General Motors cut car production.

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United States

Semiconductors have become an area of critical concern for US policymakers. Increasingly, decision-makers across industry and government worry that the country's innovative edge will be squandered through intellectual property thefts and forced technology transfers to global competitors.

11% of worldwide fabrication capacity is in the US. This share has remained stable over time, but most new and advanced capacity is located overseas in Asia.

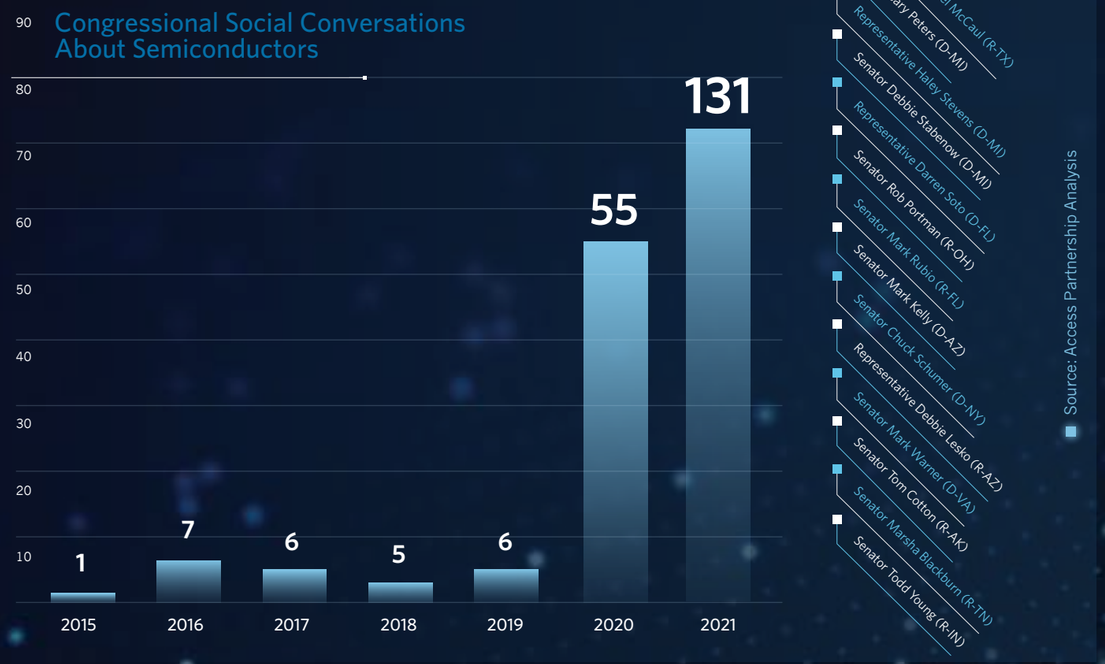
$52 billion of proposed government funding to build US manufacturing capacity and improve domestic semiconductor supply chains.

730+ firms in the US are involved in the semiconductor manufacturing process. Their activities are primarily located in California, Texas, Oregon, and New York.

$30 billion in annual value add provided to the US economy by the semiconductor industry, which is 1% of total manufacturing value add.

16% of the industry's domestic sales are spent on R&D, significantly higher than the US average of 5.4%.

Who in Congress is talking about semiconductors?



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Key Executive Branch Stakeholders

Over the last five years, Congress has taken several actions to address US leadership in semiconductors and other emerging and foundational technologies.

2017
approved corporate tax reforms for US chip companies in a bid to strengthen the industry's global competitiveness.

2018
enacted the Export Control Reform Act, which granted the Department of Commerce new powers to control the export, re-export, or transfer of emerging and foundational technologies.

2018
enacted the National Quantum Initiative Act to build a related federal program to build a 10-year plan to accelerate development of quantum information science and technology applications.

2018 & 2019
referred The American Foundries Act, which would have funded additional micro-electronics R&D, to committee.

2020
introduced the Creating Helpful Incentives to Produce Semiconductors (CHIPS) for America Act.

2020 & 2021
introduced the Endless Frontier Act.

2020
passed the 2021 National Defense Authorization Act (NDAA), which enacted the CHIPS Act by authorizing financial assistance to semiconductor companies. The FY21 NDAA also included measures for secure supply chains, funding for advanced microelectronics research, and a federal program to strengthen domestic ATP capabilities.

2021
introduced the Facilitating American- Built Semiconductors (FABS) Act that includes a permanent 25% tax credit for semiconductor manufacturing investments.

2021
the Senate passed the US Innovation and Competition Act (USICA), which includes CHIPS Act funding, the Endless Frontier Act, and additional funding for legacy chips used in automotive industry.

2021
the House passed several USICA-alternative bills, including the National Science Foundation (NSF) for the Future Act.

Companies should...

- Advocate to Congress the need for once-in-a-generation semiconductor funding and incentives and shape the terms and contours of the program.
- Proactively educate the Biden Administration on the second- and third-order ramifications of semiconductor technology tariffs, export controls, and trade restrictions on the global competitiveness of US businesses, namely competitors in Europe, Israel, and Asia.
- Educate the Department of Defense on advances in quantifiable risk assurance for semiconductor supply chain security to end reliance on geography-based security so US military buyers can access the best commercially-available chip technologies.

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Europe

Digital Sovereignty Meets Semiconductors

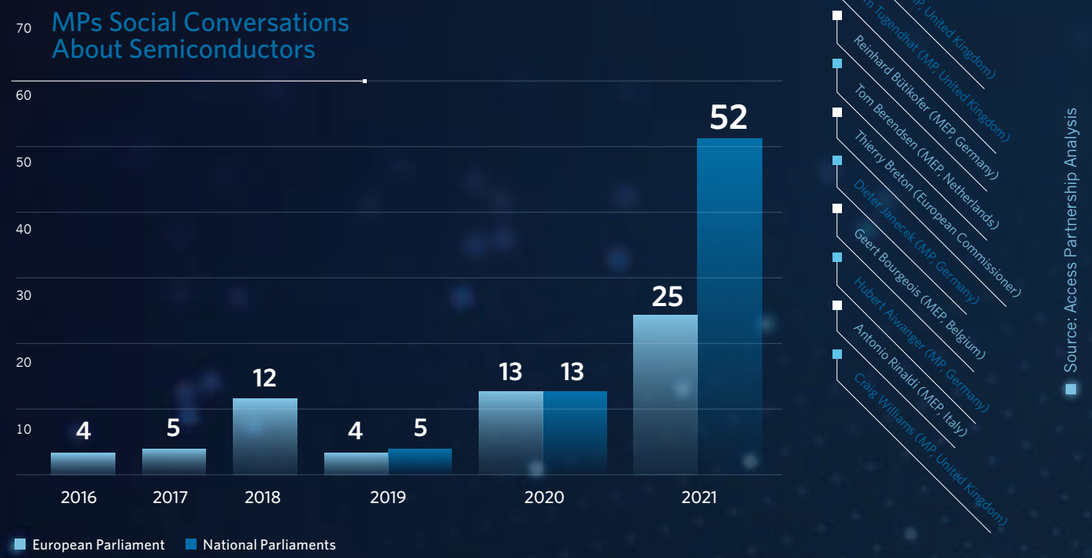
Digital sovereignty is a larger European attitude towards lower dependence on non-European technology for digital infrastructure, as well as prioritization of security and resiliency for the European Union (EU) Single Market.

Key European officials believe that digital sovereignty is not possible if Europe does not have its autonomous capacity to manufacture microelectronics, such as semiconductors. This increasing shift toward industrial sovereignty comes at a time when **ongoing global semiconductor shortages have impacted significant European industries,** such as automotive production in Germany.

In March 2021, the European Commission (EC) adopted the **Network and Information Security (NISC2) Directive** which aims to increase EU-wide cybersecurity and supply chain security in critical infrastructure, including semiconductors.

Also, in February 2021, **France and Germany** drafted a joint issue paper on the **concrete industrial policy measures** needed to reinforcing industrial and digital sovereignty. With backing from key member states at an EU policymaking level, the industrial policy non-paper **was crucial for subsequent efforts to update EU and regional supply chain policies.**

Who in European parliaments is talking about semiconductors?



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Who are Europe's Champions?

European companies generally specialize in niche markets such as the automotive industry, energy applications, and industrial automation, with little production of computer or consumer-related semiconductors. Additionally, European companies produce supporting components or technologies such as lithographs, but lag in semiconductor design and fabrication capabilities.

Company	Type	2020 Revenue (in USD billions)	US Competitors
Robert Bosch Group	Microelectromechanical Systems (MEMs)	84.12	PNI Sensor, Rogue Valley Microdevices
ASML	Capital Equipment	16.62	Applied Materials, KLA, Lam Research, Onto Innovation, Ultratech
STMicro	Systems-on-a-chip (SoCs)	10.22	
Infineon	Microcontrollers (MCUs)	10.08	Analog Devices, Micron Technology
NXP	Microcontrollers (MCUs), Microprocessors	8.61	Qualcomm, Texas Instruments
ams AG	Sensors	2.26	Analog Devices, Cirrus Logic, Maxim Integrated, Microchip Technologies, MPS, Semtech, Silicon Labs, Texas Instruments
ARM	Microprocessors	1.9*	AMD, ABM, Intel, Nvidia, Qualcomm

Source: Access Partnership Analysis, Company Quarterly and Year-End Filings

*2019 revenue

EU industrial policies

The EU and EC are increasingly taking an aggressive stance towards establishing EU technology competitiveness and maintaining intra-EU value chains. The EC has focused on improving regional semiconductor manufacturing capabilities, especially in design and fabrication. By pooling EU, national, and regional subsidies, the EC has been able to fund larger-scale projects than would have been possible at the individual member state level.

New European Industrial Strategy for Electronics (2013)
Aimed to increase EU share of global semiconductor manufacturing to 20% by 2020 and induce USD 113 billion in industry investments. Provided USD 11.3 billion in public and private funding for R&D activities.

Horizon 2020 (2014)
Aimed to secure technology supply chains to assure EU technological independence. Provided USD 95 billion of funding to spur the EU's industrial leadership. Included USD 6 billion to fund a program to grow semi-conductor capabilities (ECSEL JU).

Joint Microelectronics Project (2018)
Aimed to encourage investments in internet-connected devices and car technologies. Provided USD 2 billion for a joint initiative between France, Germany, Italy, and the United Kingdom.

New Industrial Strategy for Europe (2020)
Highlighted the need for strategic technological autonomy and sovereignty. Acknowledged that funding and programs will not solely jumpstart an EU semi-conductor industry.

Semiconductor Development Alliance (2020)
Alliance between 17 member states to develop next generation semiconductors and processers. Proposed USD 171 billion in project funding from various sources including the European Recovery and Resilience Facility.

Digital Compass Plan (2021)
Established a vision for EU digital transformation by 2030. Aimed to boost EU technology and digital sovereignty by funding high-tech initiative. Aimed to increase EU share of global manufacturing of cutting-edge semiconductors to 20%.

Horizon Europe (2021)
Aimed to fuel scientific and technological excellence and boost competitiveness. Provided USD 117 billion for public sector research and innovation, as well as collaboration with industry. Included USD 6 billion for a partnership to boost the EU semiconductor industry.

Companies should...

- Seek out, partner, and engage with EU funding programmes such as Horizon Europe to help the EU meet its digital transformation goals.
- Push back on a "Fortress Europe" mentality underpinning Digital Sovereignty by educating policymakers in Brussels and influential member state capitals on the benefits of open and global trade supply chains.

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China

$350 billion in annual imports of semiconductors.

12% of worldwide fabrication capacity is in China. This share has increased over the last decade and is projected to reach 28% in 2030.

25% of worldwide semiconductor consumption comes from China. This demand outpaces the overall global market.

$150 billion of government funding has already been channeled into China's domestic semiconductor industry with additional funding promised.

16% of domestic demand is met with domestic production.

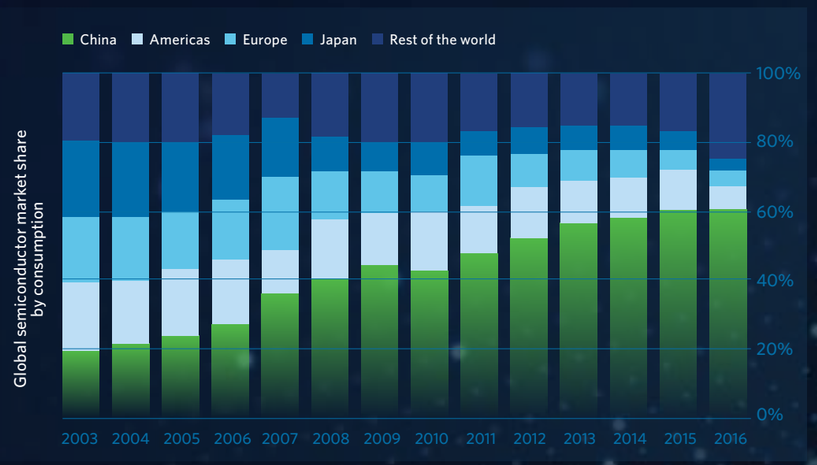
What is China's semiconductor industry's value add share?

China's existing capabilities primarily center on **back-end assembly, testing,** and **packaging (ATP)** and lag in the fabrication of semiconductors. Chinese companies hold global share across the value chain at the following levels:

38% of ATP back-end manufacturing.	**16%** of wafer fabrication front-end manufacturing.	**16%** of fabless chip design.	**13%** of manufacturing materials.	**7%** of discrete, analog, and other (DAO) chip design.	**5%** of logic chip design.	**2%** of manufacturing equipment	**<1%** of electronic design automation (EDA) tools and core IP architecture.	**<1%** of memory chip design.

Hungry for Chips

China imports far more semiconductor products than any other country



Source: The Belgian Dentist, Seeking Alpha

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How is China building its domestic semiconductor capabilities?

National Integrated Circuit Plan (2014)

- **Goal to meet 70% of China's semiconductor demand with domestic production by 2025.**
- Established the National Integrated Circuit Industry Investment Fund (CICIIF).
- Initial USD 19 billion government investment; added second of USD 29 billion investment in 2019.
- Total USD 150 billion investment target including other sources such as provincial and municipal governments and state-owned enterprises.

Made in China 2025 (2015)

- **Goal to meet 80% of China's semiconductor production by 2030.**
- Lists semiconductors as a top domestic manufacturing capability priority.
- Establishes a Technical Area Roadmap: by 2020, semiconductor design and manufacturing should be one to two generations behind industry leaders. By 2030, China should have leading capabilities across the semiconductor value chain.

Five Year Plans

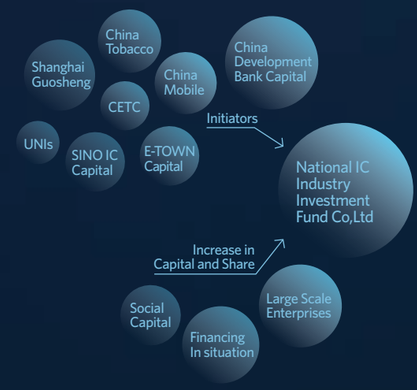
13th Plan for 2016-2021

- Prioritizes development of DRAM chips to lessen dependence on foreign memory chips.

14th Plan for 2021-2025

- Goal of creating technology independence for China.
- Describes technology innovation as an issue of national security.
- 2021 Government Work Report identifies semiconductors as a technology area prioritized by major breakthroughs.

CICIIF Structure



What is China's strategy to implement industrial plans?

Domestic Subsidies

Regional, provincial, and national funds, investment vehicles, and policies that incentivize industry investments, such as tax breaks.

Foreign Direct Investment

Outbound Chinese investments to achieve technology breakthroughs and shrink China's technology gap, such as mergers and acquisitions with US chip companies.

Joint Ventures

Strict inward Chinese foreign direct investment policies for foreign companies to access the Chinese market, such as required joint ventures with a Chinese firm.

Forced Technology Transfers

Strict inward Chinese foreign direct investment policies for foreign companies to access the Chinese market, such as required intellectual property transfers to private or public Chinese entities.

National Integrated Circuit Plan and Made in China 2025: Retrospective

Reached the USD 150 billion investment goal by 2020 but is not on track to achieve the 70% self-sufficiency goal.

Increased interest in developing a domestic semiconductor manufacturing capabilities as the US has imposed strict semiconductor export controls.

Published 14th 5-Year plan with provisions to expedite development of domestic manufacturing capabilities.

Instituted new state policies to add tax cuts for semiconductor manufactures, preferential financing policies, and tax-free imports of machinery and raw materials.

Companies should...

- Improve on-the-ground open-source information gathering of Chinese government intentions.
- Establish flexible China engagement and geopolitical risk management strategies that enable companies to continue to engage with the Chinese market while adhering to home country constraints.

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Northeast Asia

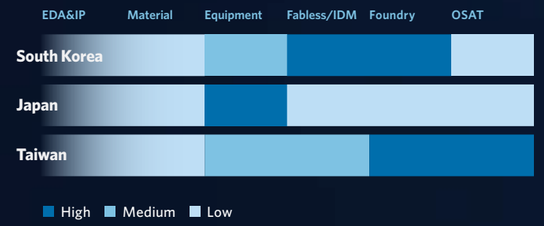
Northeast Asia is a global powerhouse of semiconductor manufacturing but is dependent on China for supplies of critical material inputs and chip demand.

Over the past decade, Northeast Asia has endured significant economic coercion efforts from China to achieve its geopolitical aims while also engaging with US efforts to challenge China for its industrial and trading practices. These factors, in combination with the supply chain constraints resulting from COVID-19, have spurred Northeast Asian governments to adopt techno-nationalist policies and economic securitization measures.

Northeast Asian semiconductor companies have also had to make difficult decisions including near-shoring supply chains and diversifying key manufacturing activities.

- **TSMC (Taiwan)** is building new chip plants in the US and Japan, as well as evaluating building one in Germany.
- **Samsung (South Korea)** is bolstering investments in its foundry and logic chip operations to tap new growth beyond its staple memory chip market.
- **Kioxia (Japan)** delayed its IPO following a US ban on supplies of American technology to Huawei, a major client of Kioxia's.

Relative Strengths of Northeast Asian Countries Across the Semiconductor Value Chain

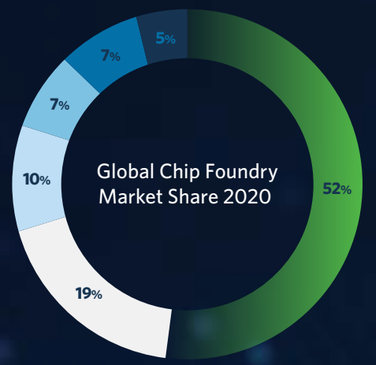


Source: Deloitte Analysis

EDA - Electronic Design Automation software | **IP -** Intellectual Property core
IDM - Integrated Device Manufacturer | **OSAT -** Outsourced Semiconductor Assembly & Test

Taiwan

Taiwan is the world's leader in semiconductor foundry manufacturing, possessing strong capabilities in original equipment manufacturing (OEM), wafer manufacturing, and a complete industry supply chain. Dominating the market are TSMC and UMC, which have received significant public sector funding. In 2007, **Taiwan's semiconductor industry overtook that of the US and was second only to Japan.**



Source: IC insights 2020

Policies

2016
New Southbound Policy
Aims to leverage Taiwan's economic, trade, technological, and educational assets to redirect outbound investment away from mainland China into Southeast Asia.

2017
5+2 Industrial Innovation Plan
Seeks to strengthen Taiwan's global competitiveness across technological industries, including semiconductors, while encouraging more balanced development domestically.

2017
Academia-Industry Research Alliance Project
Aims to galvanize multi-stakeholder cooperation and cultivate high-tech talent through partnerships between universities and companies in advanced manufacturing fields. The project funds R&D for IC design, wafer manufacturing, and ATP.

2018
Chip Design and Semiconductor Technology Development and Application Plan
Initiated by Taiwan's Ministry of Economic Affairs to build an integrated industry chain for the development of IoT and AI.

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Japan

Though Japan's share of the global semiconductor market has declined significantly since the 1990s, **it still leads the supply of raw materials, equipment,** and **small active-passive components** like transistors, silicon-controlled rectifiers, resistors, and transformers.

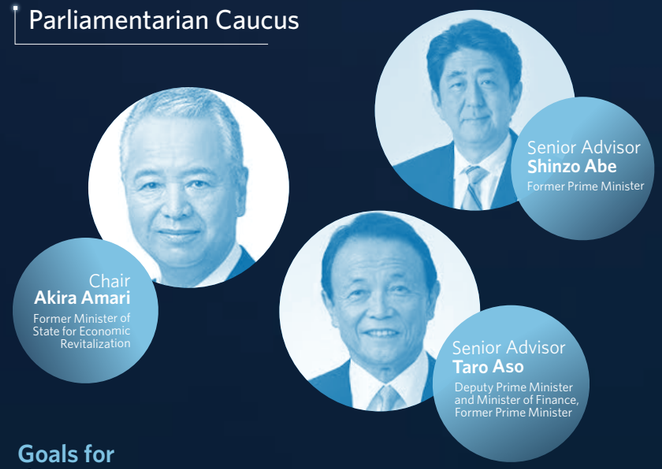
Silicon Island in southern Kyushu, home to Japan's major IDMs, accounts for about **5% of global semiconductor production alone.**

Japan additionally has a global monopoly over resist and high-purity hydrogen fluoride chemicals used as etching gas in semiconductor production.

Ongoing Japan-South Korea Trade Dispute

In 2019, Japan curbed exports of key semiconductor manufacturing materials such as hydrogen fluoride and resist polymers to South Korea on national security grounds following the escalation of a longstanding dispute over reparations for Japan's colonial-era use of forced labor. The two countries subsequently removed the other's most-favored nation trading status, creating additional restrictions for all imports. South Korea initiated a dispute at the WTO against Japan's export curbs in 2020; an adjudication panel was established but has yet to be staffed. Both countries have since attempted to re-shore or diversify critical material input supply chains.

LDP Semiconductor Parliamentarian Caucus



Goals for the caucus:

- Build strong supply chains with allied nations (e.g., the US)
- Secure a 40% global share of advanced power semiconductors by 2030
- Develop medium - and long-term semiconductor strategies
- Create a semiconductor R&D fund
- Support capital tie-ups with US companies
- Tax incentives and loans to local companies
- Submit recommendations this fall for Japan's FY 2022 budget
- Cultivate a domestic workforce

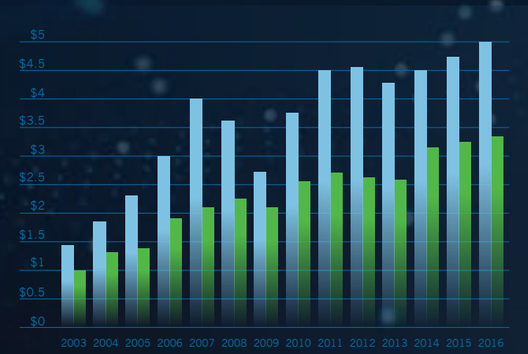
South Korea

South Korea's semiconductor industry has benefited from government subsidies and financial backing from the **country's privately-owned industrial conglomerates known as chaebol.**

In 2019 the Moon Jae-in administration announced USD 860 million in investments for next-generation semi-conductors by 2030. The administration also unveiled plans in 2019 to earmark USD 6.5 billion in R&D for local manufacturing materials, parts, and equipment following Japan's export controls on key chemical inputs.

Additionally, in May 2021 the administration announced the K-Semiconductor Belt Strategy to increase investment, tax credits, and special incentives for domestic chip manufacturers.

Semiconductor Materials Market in South Korea (USD in Billions)



Source: SEMI Information Research and Statistics

Companies should...

- Build in macro geopolitical risk strategies to navigate simmering Korean-Japanese tension that directly impact supply chains.
- Develop and manage political relationships across Taiwan, Japan, and South Korea as they nurture multi-billion-dollar investments in outsourced foundry infrastructure.

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Southeast Asia

Southeast Asia plays a key role in back-end semiconductor manufacturing. Despite specializing in low-value add manufacturing such as assembly, testing, and packaging (ATP), some Southeast Asian countries such as Singapore are building high-value add capabilities in research and design. The region does not have any major regional champions. Rather, it serves as a location for multinational corporations such as TSMC and Samsung to conduct parts of their semiconductor manufacturing.

Southeast Asia attracts multinational corporations with favorable government policies such as special economic zones, export processing zones, and industrial bonded zones. These policies allow local companies to import manufacturing inputs tax-free, solidifying the region's prominent role in global trade networks.

Penang, Malaysia

- **Established as Malaysia's first free trade zone in the 1970s and drew key investments from semiconductor giants such as Intel, Robert Bosch, and AMD.**
- Supports manufacturing for more than 350 multinational corporations.
- Contributes approximately **8% of the global back-end semiconductor output,** making it among the world's leading location for microelectronics assembly, packaging and testing.
- Contributes an estimated **5% of global semiconductor exports** (2019).
- Actively **developing and implementing favorable policies** to attract more foreign manufacturing investments and business, including funding public-private partnerships to cultivate local manufacturing skills and talent.

Singapore

- **Serves as a trade and transport corridor with a large logistics infrastructure.**
- In 2021 Singapore committed to invest USD 15 billion to expand its pivotal role in maritime trade; it previously completed initiatives to digitalize trade and logistics processes through the development of a digital trade platforms (Networked Trade Platform) to streamline import and export logistics.
- **Provides public funds and tax incentives to help companies** construct fabs and develop innovation capabilities such as wafer fabrication and advanced outsourced semiconductor assembly and test services (OSATs) not found elsewhere in the region.
- Accounts for **5% of global wafer fabrication capacity** and **20% of the global semiconductor equipment output.**
- Published the "Manufacturing 2030" vision of becoming a global business, innovation and talent hub for advanced manufacturing.

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Southeast Asian countries' role in the semiconductor value chain is likely to grow as US-China tensions increase and some companies seeking to relocate China-based semiconductor activities. A survey of Northeast Asian companies found that one third of respondents had already relocated some or all of manufacturing or assembly outside China in response to tensions; **55% of Japanese companies plan to move some or all operations, with the number rising to 78% and 75% among South Korean and Taiwanese companies, respectively.**

2021

GlobalFoundries announced that it is investing USD 4 billion to expand its chipmaking facilities in Singapore.

2020

Lam Research announced it is establishing an advanced technology production plant in Malaysia that will be the wafer fabrication equipment leader's largest facility in the world.

2020

Robert Bosch Group announced it is building a facility in Malaysia for final testing of semiconductor components and sensors, R&D, and training.

2020

USI (a subsidiary ASE Holding) announced an USD 200 million phase-one investment in a facility in Vietnam for the production and assembly of chips for wearable electronic devices.

Cavite, Philippines

- Established as a free trade zone in 1980 and evolved into an economic zone in 1995.
- Drew **key investments from semiconductor giants such as Intel,** which invested more than USD 4 billion through the early 2000s.
- Supports manufacturing for over 70 multinational semiconductor companies including Analog Devices, Cypress Semiconductor, Maxim Integrated, and ON Semiconductor.
- Actively **developing and implementing favorable policies** to attract more foreign export-oriented manufacturing and service facilities, including financial incentives and preferential tax structures (i.e., exemptions from corporate income tax).

Companies should...

- Competition amongst governments to attract relocating investment from China: "engage advice on leveraging regional competition for investment"?
- Engage with governments and manage political relationships to access economic growth initiatives, incentives, and funding to promote regional capabilities in both front-end and back-end semiconductor manufacturing, as well as design.
- Monitor the shifting tax, trade, and labor rules as they affect the workforce, supply chain, and access to talent in key markets.

Works cited in this section are listed on page 19.

Conclusions

1

Advocate legislators for final approval and distribution of incentives for private and public-private collaborative semiconductor research, development, and manufacturing.

2

Educate government officials and legislators on the negative ramifications of increased export controls and trade restrictions on the competitiveness of national champions. Advocate for **the benefits of open and global trade supply chains.**

3

Reframe semiconductor and semiconductor-adjacent technologies as **areas of competitive advantage** that can be used to keep dependent adversaries in check without spurring the build-out of their own competing domestic capabilities.

4

Establish a flexible China strategy that not only enables companies to continue to engage with the Chinese market while adhering to home country constraints, but also responds to the fast-paced and ever-changing regulatory landscape both in China and abroad.

5

Shape **favorable tax** and **market access policies** and **manufacturing incentives** in Southeast Asia as the region continues to expand its share of global assembly, testing, and packaging activities, as well as build high-value capabilities in research, development, and design of semiconductors.

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