

## Special Analysis

# China's Continuing Pursuit of an Indigenous Semiconductor Production Capability

Steve Conway, Jie Wu, and Earl Joseph  
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## HYPERION RESEARCH OPINION

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Although China represents more than one-third of the global market for semiconductors, the country relies heavily on foreign sources, especially U.S. chipmakers and foundries headquartered in other Asian countries, for a majority of devices critical to Chinese-made products ranging from smartphones to industrial machinery and supercomputers. For the past few decades, China sought to develop an indigenous capability in an effort to reduce its dependence on the foreign supply of components. Its most recent major effort, the “Made-in-China” semiconductor initiative launched in 2015, targeted supplying 40% of China's semiconductor demand with homegrown products by 2020 and 70% by 2025.

- However, the program, and China in general, fell considerably short of the 2020 goal, supplying closer to 20% of the country's domestic demand. China's National Bureau of Statistics recently reported that semiconductor imports rose 14.6% in 2020 over 2019.

China has implemented a host of government-sponsored initiatives over the years in an effort to close the technology and production gap that exist with leading-edge foreign counterparts. These efforts include tax breaks, advantageous financing, favorable import and export terms, financial incentives to attract semiconductor experts from overseas, and targeted university funding to address key semiconductor production technology gaps.

The results of China's effort have been mixed so far, with some progress in recent years despite the country's failure to achieve the ambitious 2020 goal of its "Made in China" five-year plan. However, Beijing's long-term commitment, coupled with a broad range of policy, financial, and technical support to the sector, could significantly advance China's position as a semiconductor supplier in the coming years.

## SITUATION OVERVIEW

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China has established a broad range of programs designed to advance its domestic semiconductor production capabilities.

### ***Generous Government Policies***

China has provided favorable policies for the semiconductor and software industries since 2000, offering a wide range of incentives including tax breaks, advantageous financing, added IP protection and favorable import and export terms. In August 2020, China rolled out its *Policies for Promoting the High-quality Development of the Integrated Circuit Industry and Software Industries*. These latest policies are more generous and broader than the first update, which was released in 2011. The new

policies include a series of tax incentives, streamlined domestic listing procedures, financial support from government funds, improved intellectual property rights (IPR) protection, as well as policies to promote related research, trade, education, market application, and international collaboration.

### ***Robust Investment Environment***

China's central government and private investors are channeling significant funds into Chinese semiconductor companies. The Chinese central government has set up billions of dollars of funding for the semiconductor industry in the past five years. Foreign investors are also joining the ranks, investing in semiconductor startups based in China. China's determination to become self-reliant in semiconductors has served as an assurance for private investors looking for a handsome return on their investment. The influx of investments has not only helped boost share prices for publicly traded Chinese companies but has also helped fuel the number of promising startups in the sector. For example, Silicon Catalyst (Santa Clara, CA), an incubator and accelerator for semiconductor startups, has picked 16 (out of 350) companies in China to add to their investment portfolio within the past two years.

### ***Big Incentives For Semiconductor Experts***

In 2015, China pledged that by 2020, 40% of its semiconductors would be supplied by domestic vendors. A major challenge contributing to China's inability to meet that ambitious goal was a talent shortage in the country's semiconductor sector. China likely would have needed about 700,000 engineers in order to reach that goal, nearly double the talent count from its 2019 level.

To close the gap going forward, the Chinese government is providing incentives such as tax breaks, above average paychecks and bonuses, and subsidies for housing and education to attract semiconductor experts from other regions. Many of the country's established companies and startups were founded by semiconductor veterans educated in foreign countries and have years of experience working at leading non-Chinese semiconductor firms such as Texas Instruments, Cadence Design, AMD, and Intel. For example:

- ACM Research, a major domestic semiconductor wafer supplier providing wet processing technology for chipmakers, was founded in 1998 in Silicon Valley before it was moved to Shanghai, China in 2006. The company went public in 2017. Its founding CEO, David Wang, is a four-year veteran at U.S. company Qester Technology and got his advanced education in precision engineering from Osaka University.
- Chinese startup Enflame Technology develops chips to accelerate AI/ML model training and execution in the cloud. The company was founded in 2018 in Shanghai by Zhao Lidong (CEO) and Zhang Yalin (COO). Together, the two founders amassed over 20 years of experience at leading global companies, including AMD and Juniper Networks, before launching Enflame. CEO Zhao Lidong holds a master's degree in electronics and computer science from Utah State University.

While recruiting talent from the US and EU can be a major endeavor, convincing experts from neighboring regions is often easier. Taiwan, home of leading semiconductor producer TSMC, the world's largest semiconductor foundry, has seen a loss of talent to mainland China in recent years. In addition to housing discounts and subsidies for private schools, a seasoned chip engineer from Taiwan can expect a salary package two to three times larger than a Taiwanese company would provide.

## ***Specialized Semiconductor Programs in Universities***

To address its semiconductor industry talent shortage and drive long-term growth, China's central government is revising its academic priorities to stress semiconductor programs more strongly. For example, in 2020 China's cabinet voted to establish a semiconductor university program which will be designated a first-level discipline, advancing from IC's (integrated circuits) current second-level status. This new initiative will allow more universities to create similar programs and enable semiconductor-related projects to get funding and resources more easily.

- In Oct, 2020, the city of Nanjing launched China's first integrated circuit university. Nanjing Integrated Circuit University (NICU) will focus on teaching semiconductor domain knowledge and training its "learners" (as opposed to "students") specialized skills that semiconductor companies are looking for. All the courses will be taught by seasoned chip engineers and industry experts, in collaboration with the university's existing professors.

## **FUTURE OUTLOOK**

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The results of China's efforts have been mixed so far, with some progress in recent years despite the country's failure to achieve the ambitious 2020 goal of its "Made in China" five-year plan. China's increased financial investments along with successful efforts to repatriate Chinese HPC and AI experts living abroad are likely to advance China's position as a semiconductor supplier, and China's push to produce more semiconductors domestically could have multiple impacts:

- China's continued investment in advancing the country's semiconductor industry will benefit many chip-enabled sectors, including the country's consumer electronics, automotive and communications sectors (including 4-G mobile technology), along with China's space program. Semiconductors are also at the heart of cloud computing, AI & ML and robotics development.
- High performance computing (HPC) will also benefit from having access to more advanced semiconductors. Substantial investments by the government will help cutting-edge technologies such as advanced lithography systems, 7nm chip manufacturing, and memory chip design. Advanced semiconductor technologies will likely power many of the country's HPCs going forward, helping to secure China's status as a leading exascale power and sustaining its position as one of the global leaders in HPC.

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## Headquarters

365 Summit Avenue

St. Paul, MN 55102

USA

612.812.5798

[www.HyperionResearch.com](http://www.HyperionResearch.com) and [www.hpcuserforum.com](http://www.hpcuserforum.com)

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