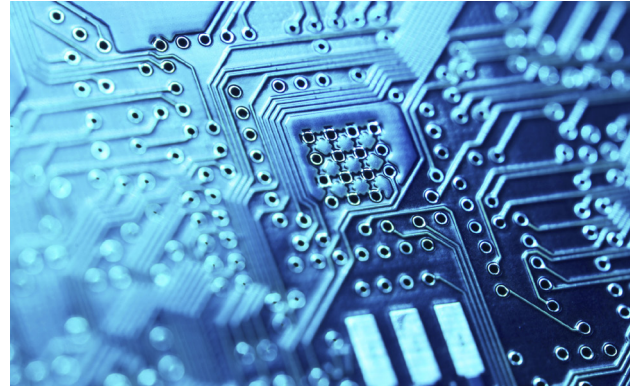
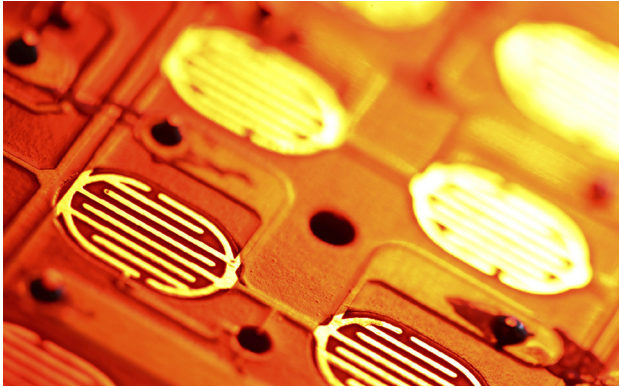


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Semiconductors in China: Brave new world or same old story?

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China is stepping up efforts to become a major player in semiconductor design and manufacturing. If it succeeds, integrated-circuit companies around the world could face significant risks and opportunities.

Executives of global semiconductor companies have had their eyes on China for many years, primarily as a customer-rich end market and a source of innovation. But now they will need to take an even closer look. Government stakeholders in China have been reconsidering the risk posed by the country's heavy reliance on others for semiconductor components and capabilities, and they are carrying out policy changes that could correct for this dependence. Pair these policy efforts with private-market forces that are slowly but surely strengthening the capabilities of mainland semiconductor companies and multinational chip makers competing in China will likely face a very different operating environment—one with new risks and opportunities.

What's changing?

China is by far the largest consumer of semiconductors; it accounts for about 45 percent of the worldwide demand for chips, used both in China and for exports. But more than 90 percent of its consumption relies on imported integrated circuits. Integrated-circuit companies in China entered the semiconductor market late—some two decades after the rest of the world—and have been playing catch-up ever since in an industry in which success depends on scale and learning efficiencies. The Chinese government made several attempts to build a local semiconductor industry, but none really took hold. Now, however, things are changing on both the business and policy fronts.

Low-cost smartphones designed in China are flooding the market. For instance, Android phones designed in China now represent more than 50 percent of the global market, compared with their negligible presence five years ago. Lenovo's significant deals early in 2014—first acquiring IBM's low-end x86-based server business for \$2.3 billion and then buying Motorola from Google for almost \$3 billion—further suggest that the customer base for hardware is moving to China. Meanwhile, Beijing and Shenzhen have become innovation hotbeds for wearable devices and other connected consumer electronics. Technology companies in these regions are not trailing others in this area of innovation; they are running neck and neck with other early entrants.

Multinational corporations in every industry—from automotive to industrial controls to enterprise equipment—increasingly are establishing design centers on the mainland to be closer to customers and benefit from local Chinese talent. McKinsey's proprietary research indicates that more than 50 percent of

PCs, and between 30 and 40 percent of embedded systems (commonly found in automotive, commercial, consumer, industrial, and medical applications), contain content designed in China, either directly by mainland companies or emerging from the Chinese labs of global players. As the migration of design continues, China could soon influence up to 50 percent of hardware designs globally (including phones, wireless devices, and other consumer electronics).

Fabless semiconductor companies are also emerging in China to serve local customers. For instance, Shanghai-based Spreadtrum Communications, which designs chips for mobile phones, and Shenzhen-based HiSilicon Technologies, a captive supplier to Huawei and one of the largest domestic designers of semiconductors in China, are among the local designers that have shown rapid growth over the past few years.

There has been slower but steady progress among local foundries. For reasons including costs and scale—and, in some cases, export controls—these players traditionally have been reluctant to invest in cutting-edge technologies, always lagging three or four years behind the industry leaders. But the performance gap is shrinking. As global players such as Samsung, Taiwan Semiconductor Manufacturing Company, and Texas Instruments set up shop in China, leading local foundries such as Shanghai Huali Microelectronics Corporation, SMIC, and XMC are poised to benefit from the development of a true technology cluster. At the same time, fewer and fewer chip designs will be moving to technologies that are 20 nanometers and below; following Moore's law is becoming too expensive and is of limited benefit to all but a small set of global semiconductor companies. As a result, low-cost, lagging-edge Chinese technology companies will soon be able to address a larger part of the global market.

A market-based policy effort

The Chinese government is now putting significant funding and effort behind new policies relating to the development of the semiconductor industry. The government's previous attempts to build the industry, dating all the way back to the 1990s, had mixed results because funding plans and incentives were focused more on research and academia than on business. Additionally, investments were fragmented—at one point, the government had invested in 130 fabrication sites across more than 15 provinces, none of which was able to capitalize on the scale and scope of its neighbors' sites, and supporting industries never materialized.

The government, realizing that earlier bureaucrat-led investment initiatives failed to bring the desired results, is now aiming to take a market-based investment approach. In this case, decisions about allocating for-profit investment funds will be managed by professionals but will remain aligned with the government's policy objectives. Chinese officials have convened a unique task force charged with setting an aggressive growth strategy (see sidebar, "A different type of task force"). This group helped develop a policy framework that is targeting a compound annual growth rate for the industry of 20 percent between now and 2020, with potential financial support from the government of up to 1 trillion renminbi (\$170 billion) over the next five to ten years. Investments will be made by a national investment vehicle (the National Industry Investment Fund) and provincial-level entities. These entities will invest across multiple categories, including project finance and domestic and foreign acquisitions, as well as traditional research and development subsidies and tax credits.

To avoid the fragmentation issues of the past, the government will focus on creating national champions—a small set of leaders in each critical segment of the semiconductor market (including design, manufacturing, tools, and assembly and test) and a few provinces in which there is the potential to develop industry clusters. For instance, SMIC, a leading foundry headquartered in Shanghai, is building a 300-millimeter fab in the Beijing Economic and Technological Development Area. The company signed cooperation agreements with the national and local governments and announced a joint investment of \$1.2 billion. Investors include the Beijing Municipal Commission of Economy and Information Technology, the Institute of Microelectronics of Chinese Academy of Sciences, and the Beijing city government.

The Chinese government has actively pursued consolidation to spur the creation of national champions. For instance, Tsinghua Unigroup, a state-owned enterprise, recently bought two of the top four Chinese fabless companies—in 2013, it acquired Spreadtrum for \$1.7 billion and RDA Microelectronics for \$0.9 billion—and aims to combine them into a single entity. The new policy framework specifically encourages consolidation within China's assembly-and-test market segment.

Implications for semiconductor players

China released the high-level framework for its new national semiconductor policy in June 2014; the details and the long-term

effects of its new approach to developing the industry remain to be seen. Will it lead to a world-class semiconductor industry, or will Chinese semiconductor companies continue to lag behind global players? Three medium-term effects seem likely.

Pressure for localization will increase. China's strong desire for national champions may further tilt the system in favor of local players. According to industry estimates, Chinese original-equipment manufacturers will design more than half of the world's phones in 2015.¹ Under the national-champions model, they may be encouraged to take advantage of domestic suppliers' low-cost strategies and strong local technical support. Additionally, in the wake of global data-privacy and security concerns, there has been even more of a push from the Chinese government for state-owned and private enterprises to purchase from local system suppliers (that, in turn, are more likely to source from local semiconductor vendors).

More partnership opportunities will arise for second-tier players. Many of the Chinese government's previous policies have not offered opportunities for global players to benefit. However, government leaders in China's semiconductor sector are now beginning to realize that the country needs to partner with global technology companies to improve the local talent base and supply chain. As a result, they are more open than ever to "win-win" engagements between global players and national champions. For their part, top-tier multinational semiconductor companies traditionally have had less incentive to share their intellectual property or transfer technology to China. As such, second-tier players may fare better in this evolving ecosystem since they have less to lose than global giants—and everything to gain. In the winner-takes-all semiconductor markets, these players may benefit from their Chinese partners' deep pockets, becoming better able to match the investments of market leaders.

Chinese companies will become more aggressive in pursuing international mergers and acquisitions. Indeed, it would be quite difficult for Chinese players to build a complete and competitive semiconductor value chain without capitalizing on foreign assets; collaborations between Chinese and global players probably will not be enough to meet the country's objectives. We should expect China to continue to actively seek opportunities to acquire global intellectual property and expertise, usually with the intent of transferring them back home. What's still to be determined, however, is how global governments will react to proposed deals in light of the emerging policy and market changes.

¹ Ian Mansfield, "Chinese phone manufacturers expected to take half the market in 2015," *Cellular News*, March 10, 2014, cellular-news.com.

A different type of task force

The Chinese government has convened a task force whose composition and oversight differs markedly from previous groups charged with building a strong domestic semiconductor industry.

The task force includes four important ministries that operate under the State Council of the People's Republic of China. They are the Ministry of Industry and Information Technology, which takes the lead on formulating industrial strategies, policies, and standards; the Ministry of Science and Technology, which drafts policies and plans relating to scientific-research programs and institutions; the Ministry of Finance, which validates the proposed investment plan and assesses it for risk; and the National Development and Reform Commission, which monitors the overall process and reviews the policy draft.

What's different this time, however, is that the task force includes the top 10 to 15 leaders in China's semiconductor industry (convening executives from fabless designers, foundries, and equipment manufacturers), and overarching leadership for the project from Vice Premier Ma Kai, one of the government's highest-ranking officials.

This committee had a direct influence on the State Council during its drafting of the *Guideline of the National IC Industry Development Promotion*, the high-level policy framework that was shared publicly in June 2014.

How should multinational players respond?

Most global semiconductor players have invested heavily in their Chinese operations over the years, but many are still operating below their potential, especially in functions beyond sales and marketing. Considering the emerging policy and business trends we've just discussed, we believe it's a good idea for leaders to inventory their company's current position in China.

This process should start with the most timely and immediate concern—the potential effects of changing Chinese policy. Questions for reflection might include: How will you align your operations with the Chinese government's new plans? Are your relationships in China strong and deep enough to provide you some warning of potential risk as a result of domestic-policy changes? Do you have an early sense of what those risks might be, and a rapid-response plan to address them? Could you gain advantage by approaching the government with a win-win idea?

For multinational companies operating in China, it is impossible to separate political and regulatory concerns from business—which is why it is also necessary for leaders to take stock of the overall market and the capabilities they bring to the table.

Market-level questions might include the following: Given the different buying factors and supplier-management

philosophies of Chinese customers, do you still have a winning product road map? Can you respond to the emerging needs of Chinese-based customers as fast as a local company can? Have you followed your global customers as they set up design centers on the mainland? Which Chinese champions are emerging, and which markets will they attack?

Capabilities-level questions might include the following: How are you leveraging Chinese manufacturing and design talent to win in China—or to win globally? Are your leaders in China as strong and empowered as they are in your home region? Do your global leaders have enough connections in, experiences with, and insights about the Chinese market? How robust is your talent pipeline in China? Can you act as “one company” in the country, or do organizational silos prevent collaboration across the sales, product-development, government-relations, and manufacturing functions?

There is no one right answer to any of these questions; depending on its role and standing in the market, every company faces its own unique challenges in China. Accordingly, we have seen leading semiconductor companies adopt a number of different approaches. Some have taken the initiative to develop R&D capabilities in China, designing chips and applying for patents locally. Others have consolidated all their activities (sales, marketing, and operations, for instance) under a China CEO who reports directly to the global CEO. One company created an advisory board of senior global executives dedicated entirely to coordinating and pushing the China agenda. Other companies

have taken a talent-first approach—for instance, promoting a former China head to a global executive position to add China expertise to the boardroom and soliciting personal commitments from the CEO to visit the country every few months to review status and remove organizational barriers.



In China and elsewhere across the globe, government intervention in the semiconductor market has been a mixed bag—some successes, some missed opportunities. Still, the Chinese government is better positioned than most others to make a big policy bet, with its massive customer and installed-manufacturing base, its deep bench of engineering

talent, and its financial resources. It can afford to be patient, confident that macroeconomic forces make its hand incrementally stronger every year.

If the government follows through on its policy intent and steers substantial investment and support toward the domestic semiconductor market over the next decade, it will prompt global players to make their own moves—whether forging new and different partnerships with Chinese players, managing overcapacity in critical segments, or developing complementary or competitive policies of their own.

Whether this policy is ultimately effective or not, its impact will be felt across the industry.

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