

China's Important Role in the Global Semiconductor Industry

China has rapidly become a top priority for many semiconductor executives. While the Chinese semiconductor consumption market is the largest in the world, representing \$168B, or about 50% of the worldwide market in 2014, non-Chinese companies have supplied much of this volume. As such, there is a growing movement within China to increase its semiconductor design, IP and manufacturing prowess to become more self sufficient, given the importance of semiconductors to electronics systems. In June 2014, the State Council of China took a major step in this direction, and released its guidelines to promote and grow its semiconductor industry. These guidelines provide a multi-year plan, committing both capital and partnerships to advance this effort. The Chinese government is firmly focused on this, and is rapidly implementing a long-term plan to develop the homegrown semiconductor industry. However, the question is: will this plan succeed? Let's discuss some of the challenges and opportunities presented in China for the semiconductor industry.

EMERGING TRENDS

Ambitious targets for growth: China's 2014 policy set relatively ambitious goals for its semiconductor industry, with specific growth targets outlined through 2030 (see chart below). By 2020, the goal is to produce 16/14nm devices, with an increased presence in wireless, telecom, IoT and big data applications. By 2030, the goal is to have a fully developed, world class IC industry, with a set of leading tier 1 companies. The government is set to invest about \$19B directly and total between \$100-150B from all sources (state owned and other investors) to achieve these targets, over the next 5 years.

China's national guidelines for the development and promotion of the IC industry

China's 2014 policy for expanding the local semiconductor industry sets ambitious targets through 2030, with specific goals for various horizons, as shown in the exhibit below.

China has set ambitious targets for the local semiconductor industry.

By 2015	By 2020	By 2030
<p>Integrated-circuit (IC) industry overall revenue (design, manufacturing, packaging, and testing) exceeds 350 billion yuan (about \$55 billion)</p> <p>Volume production of 32- and 28-nm¹ chips</p> <p>Wireless and telecom IC design capabilities approach world-class level</p> <p>>30% of total packaging and testing revenues come from middle- to high-end products</p> <p>45- to 65-nm semiconductor equipment in production; 12-inch silicon wafers and other key materials in production</p>	<p>Compound annual growth rate of revenues ≥20%</p> <p>Volume production of 16/14-nm chips</p> <p>World-class IC design in applications such as wireless, telecommunications, cloud computing, Internet of Things, and big data</p> <p>World-class packaging and testing technology</p> <p>Integration of key equipment and consumables from China into the global supply chain</p> <p>Development of an advanced, safe, and secure IC industry value chain</p>	<p>World-class IC industry value chain</p> <p>A set of leading companies considered tier 1 players in the global semiconductor market</p>

¹ Nanometer.

Source: McKinsey analysis

Source: McKinsey

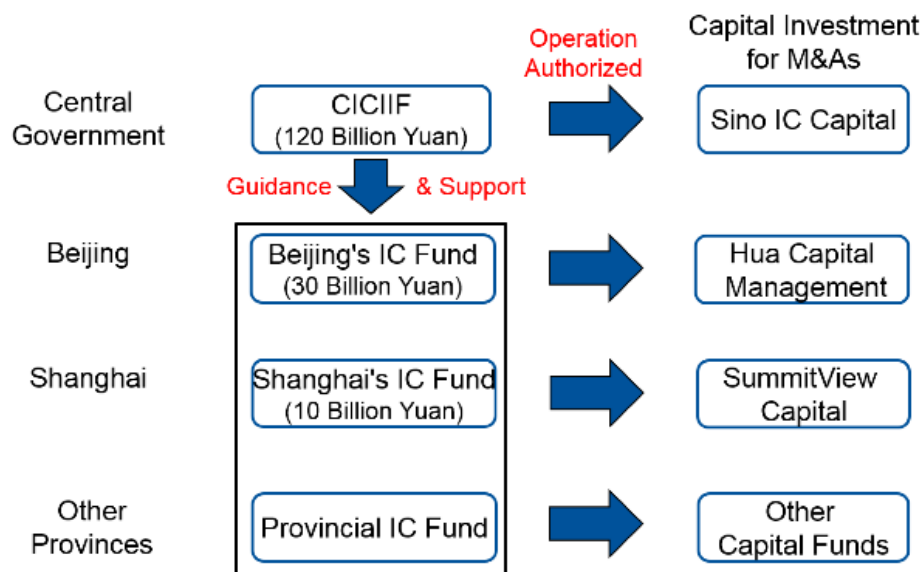
The main focus areas are as follows:

- Advanced logic IC foundry: 28 nm and 14 nm FinFET
- Memory: DRAM and non-volatile memory
- Advanced packaging/testing services
- Compute processor IC design
- Wireless/wired communications
- Operating systems
- Semiconductor manufacturing equipment

One of the key targets of the plan is for China to become more self-sufficient with regards to its semiconductor consumption. Given the increasing importance of the Chinese consumption market, in May 2015, the State Council announced a plan called “Made in China 2025”. This plan’s focus is on developing high end manufacturing capabilities, in particular semiconductors as a top priority. The end goal is for China to increase its internal usage of its home-grown semiconductors to 40% by 2020 and 70% by 2025 – an ambitious goal to be sure. These goals have important implications. For example, in the foundry manufacturing segment, this means that in order for China to meet its objectives, all incremental foundry capacity over the next 10 years would have to be built in China, according to McKinsey.

Focus on M&A and private equity: clearly, the fastest path to building a presence in this industry is to acquire existing assets of other semiconductor companies. With the wave of consolidation occurring in the semiconductor industry, there will continue to be numerous global assets for sale, whether entire companies or divisions of larger Integrated Device Manufacturers (IDM's). China will likely remain an aggressive buyer of semiconductor IP, products, and manufacturing capabilities over the next 2-3 years.

The government plan is focused on creating segment leaders, primarily through M&A. A high level view of the initial plan is below:



Note: The currency is Chinese yuan (\$1.00 = 6.2 Chinese yuan, as of the first half of 2015). Although the amount for the CICIF was announced, this could change in the future with more investment.

IC = integrated circuit

Source: Gartner (August 2015)

Source: Gartner

One of the interesting aspects of their strategy is they are allowing a market based investment approach, encouraging private equity firms to invest public funds. So far, 6 government investment funds with \$32B under management have been created: city investment funds for Beijing, Shanghai, Wuhan, Xiamen, and Hefei, and the Sino IC National Fund. For example, Tsinghua Unigroup recently announced it plans to invest \$47B over the next 5 years to build its chip empire, while PE companies such as Summitview Capital, E-Town Capital and Hua Capital have been involved in acquisitions of companies such as Mattson, Omnivision, ISSI and others. Recent press reports there may be additional interest from Chinese investors in other US based companies. We will likely see the level of interest rise over the next few years.

CHALLENGES

There are 4 key challenges that need to be addressed:

High capital expense required: a state of the art semiconductor fab can cost a minimum of \$3B and as much as \$14B to build, similar to Samsung's recently announced new fab.

Limited semiconductor IP portfolio: the majority of the world's semiconductor IP is owned by non-Chinese companies based in the US, Europe, S. Korea and Japan. These IP portfolios have taken nearly 50 years to develop and cannot be easily replicated.

Global ecosystem, supply chain and personnel: from R&D, manufacturing, sales, marketing and customer service, the semiconductor business requires a vast ecosystem and supply chain designed to meet the complex needs of global customers, not to mention the top talent required in all departments. These integrated teams need to work closely in order to properly support such global customers as Cisco, Apple and Huawei.

Regulatory approval needed: acquisitions involving multinational corporations involve a detailed regulatory review. Besides the standard regulatory approvals from the SEC, EU, China and others, there are 2 other key hurdles that need to be overcome:

The Committee on Foreign Investment in the United States (CFIUS)

According to the Treasury Department, CFIUS is an inter-agency committee authorized to review transactions that could result in control of a U.S. business by a foreign person, in order to determine the effect of such transactions on the national security of the United States. The CFIUS process generally begins formally when parties to a proposed or pending transaction jointly file a voluntary notice with CFIUS. A review period of up to 30 days begins on the next business day. While most CFIUS investigations are completed within the 30 day period, in some cases, CFIUS might initiate a subsequent investigation, which is supposed to end in a subsequent 45 days. The committee has the option to either approve the transaction, or if they find that the transaction presents national security risks, then they may enter into an agreement with, or impose conditions on, parties to mitigate such risks or may refer the case to the President for action. Clearly this is an important issue that needs to be addressed and any transaction involving foreign entities will come under examination.

Anti-Trust Review

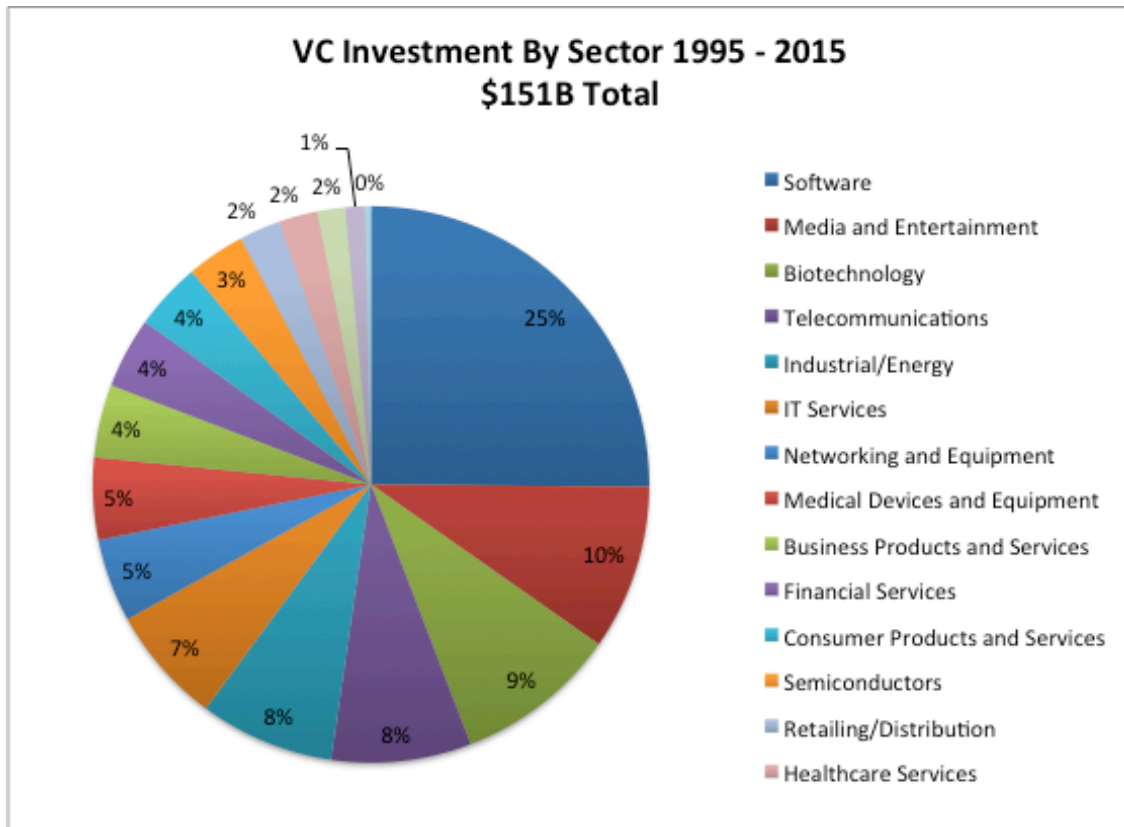
One of important pieces in U.S. antitrust law is to prevent anticompetitive mergers or acquisitions. The purpose is to preserve and promote free competition. Under the Hart-Scott-Rodino Act (HSR), the Federal Trade Commission (FTC) and the Department of Justice (DOJ) review most of the

proposed transactions that affect commerce in the United States and are over a certain size, and either agency can take legal action to block deals that it believes would “substantially lessen competition.” Although there are some exemptions, for the most part current law requires companies to report any deal that is valued at more than \$76.3 million to the agencies so they can be reviewed. Essentially, if a proposed transaction creates a monopoly situation, anti-trust laws will become an issue. Again, this is clearly an important area for companies to consider, as they target various segments of the semiconductor industry for M&A.

OPPORTUNITIES

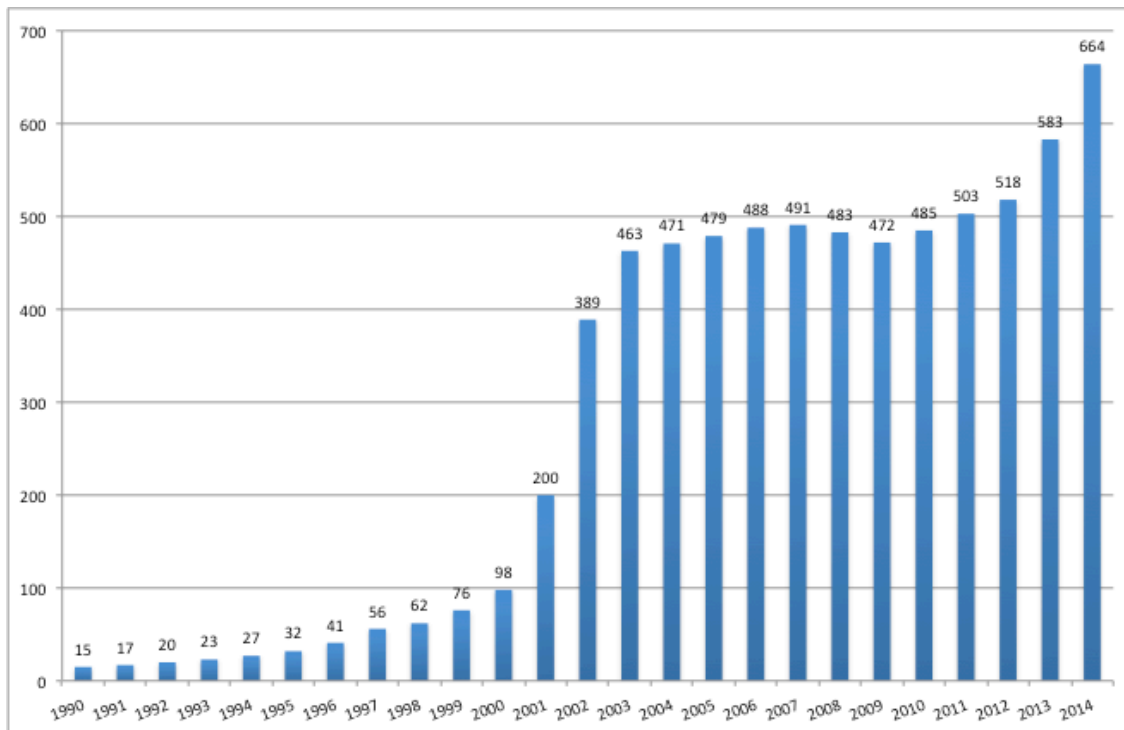
Looking at this more closely, there are numerous opportunities for China’s ambitious plans. Among them are the following:

Lack of US VC investment in semiconductors: over the past 10 years, VC’s in the US have largely focused on high growth areas such as Internet, cloud, storage, and big data, with almost no money invested in the semiconductor industry. Since 1995, according to PwC’s “Money Tree” VC report, of the roughly \$151B invested in private companies, only 3% (or about \$5B) has been invested in the semiconductor industry. Relative to this, China’s potential investment in this segment shows how serious they are in terms of their growth plans.



Source: PwC Money Tree report

Large and growing number of Chinese semiconductor design firms: according to PwC, in 2014, there were 664 semiconductor design houses (up from 583 in 2013), developing new products in China, significantly more than any other country in the world including the US. The Chinese government has offered tax incentives to promote the development of its semiconductor industry. Of the 664 companies, about 250 could be R&D units of multinationals, but at minimum, there are over 100 viable fabless semiconductor companies in China today.



Source: PwC

Shift of manufacturing to Asia: companies such as SMIC and XMC in China are increasingly manufacturing products for other US-based companies; TSMC recently announced they are building a new fab in China. Last year, Qualcomm announced a joint partnership with XMC to develop 28nm technology, and for SMIC to produce Qualcomm's server chipsets on this node. This trend will likely continue in the next 2-3 years. Here is a partial list of major partnerships:

- Intel invested \$1.5B in Tsinghua Unigroup (owns RDA and Spreadtrum)
- UMC \$6.2B collaboration with Xiamen government, Fujian Electronics
- Qualcomm partnership with SMIC (28nm technology and manufacturing)
- TSMC plan to build a 12" fab in China potentially to support Apple
- Samsung's \$7B investment in a wafer fab in Xian

China's large electronics eco-system: the majority, if not all, of the global electronics companies have either set up large manufacturing operations in China, or, like Apple, have outsourced their manufacturing to companies based

there (such as Foxconn). Clearly, this represents an important opportunity for China.

FOCUS AREAS FOR SUCCESS

To become international leaders, Chinese companies need to establish themselves as leaders in an increasingly complex business environment. This means building capabilities that can handle supporting global operations and supply chains.

They must invest in developing relationships at all levels within the customer base, both within China and internationally in order to grow revenue. This is a critical task and important area to focus on.

With regards to R&D, they must be able to manage multiple design centers globally, from India to Japan, China, Europe and the US. Most major semiconductor companies operate under this model.

IP strategy, development and protection are another area that needs to be addressed. Developing an IP strategy is a complex problem that should not be taken lightly. Most major semiconductor companies have dedicated teams handling this function on a full time basis. There needs to be a thoughtful approach and strategy to developing and executing on an IP roadmap. This would include both proprietary IP and those that can be licensed from companies such as ARM, and others.

From an M&A perspective, given the complexities that arise in all transactions, Chinese companies need to carefully evaluate their targets. Once a transaction is completed, synergies become critical to the success of the “new” company. This means not only do the financial aspects of a transaction be taken into account but also the joint capabilities of the new company as well as the synergies between the teams and the cultures of the 2 companies need to be considered and planned. Many mergers fall apart post close simply based on the fact that there are cultural differences that cannot be resolved between the 2 merged companies, so this is an important area to focus on. Collaboration will become necessary for any merger to create value and be successful.

Clearly, there are many challenges and areas to work on but none of these areas are “showstoppers”. As long as there is a strategy to attack these issues, Chinese companies will likely be successful in implementing their plans.

CONCLUSION

China remains an important market for semiconductors. Over time, we will see companies based in China emerge to challenge US-based companies. The missing links for Chinese companies are the vast IP/patent portfolios, global ecosystem and supply chain, and highly trained workforce that many top tier players possess currently. The fastest path to build these capabilities is through

acquisition. With the help of the government and local PE funds, China is rapidly catching up in this important industry. In order for these companies to succeed, they will need to become “M&A Experts”. Synergies will be critical to the success of any deal, as will the retention of key employees. These companies will also need to increase their capabilities in software, ecosystem, reference designs, and system solutions. China is an important partner and we need to remain open to further developing our partnerships within China.