5.34 Intellectual Property Protection in the Semiconductor Industry in China

Perhaps the biggest concern for firms considering doing design and R&D activity in China was the legal protection in China of intellectual property, primarily patents. Concerns about I.P. protection loom over the whole semiconductor industry in China, although more so in the design and fabrication sectors. Generally, when a firm infringes on another firm’s I.P., the infringer gains the advantage of lower costs (due to lack of design effort) and the ability to quickly go to market against rivals. Since the 1980s, the value of many large global firms has increasingly shifted from being located in tangible assets to being located in intangible assets. These intangible assets include intellectual property in the form of patents, trademarks, copyrights, and trade secrets. Firms’ I.P. must be legally protected in order to protect their market share, and if I.P. is not protected within a certain product category or geographic region, then ultimately firms might not participate in that region or product line or they might decrease their investment in R&D and design, due to not getting sufficient return on those investments.

When global semiconductor firms considered entering China in the 1990s and 2000, I.P. protection was a real concern.

At this writing, global business leaders, semiconductor executives among them, still argue that I.P. protection in China is inadequate. Nonetheless, there were important changes relating to I.P. in China during the period of this study. We must consider these changes in order to understand the context in which some (actually, many) global semiconductor firms opted to locate operations in China in the 1990s and 2000s. Perhaps surprisingly, in 1997, George

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1 PwC, “China’s Impact,” 2005, page 7, per a Brookings Institute and NYU study by Baruch Lev.

2 For a longer history of Chinese views on the role of intellectual property, which differ from those in the West, see William Alford, To Steal a Book is an Elegant Offense (Stanford: Stanford University Press, 1995.) For an understanding of events and the official discussions between the U.S. and China regarding China’s intellectual property regime in the 1980s and 1990s, see Michel Oksenberg, Pitman B. Potter, and William B. Abnett, “Advancing Intellectual Property Rights: Information Technologies and the Course of Economic Development in China,” National Bureau of Asian Research, November of 1996. In the late 1980s and early 1990s, the U.S. demanded that China expand I.P. institutions and enforcement or face sanctions, based on the Special Section 301 of the Omnibus Trade and Competitiveness Act of 1988. In response, China threatened trade barriers on U.S. imports. Eventually, China agreed to strengthen I.P. protection, however, the results of this process were not
Scalise, President of the U.S. Semiconductor Industry Association (SIA), testified before the U.S. Committee on Ways and Means that “There has been no piracy of semiconductor intellectual property to date, [as] China’s level of technological development does not yet permit it to manufacture advanced U.S. products or misappropriate U.S. chip designs.” However, six years later in 2003, Daryl Hatano of the SIA testified before the Congressional-Executive Commission on China that there have been “increasing numbers of instances” and “numerous reports of I.P. violations in China.” By 2003, the SIA was imploring the Office of the U.S. Trade Representative and the Chinese government to work together to improve I.P. protection in China.

In 2003, China’s government was viewed as not enforcing I.P. related laws and generally having a poor record of establishing the legal and institutional processes required for I.P. protection.

Emerging economies often do not have the institutions or norms to respect intellectual property in their early period of development. As an economy develops, however, protecting I.P. should (at least in theory) further economic growth, and thus become a desirable practice. With economic growth, more groups within a country (firms, individuals, as well as the state) have an increasing interest in protecting intellectual property. Firms and individuals can profit from innovation, and the state can use I.P. to further development and infrastructure goals, as well as demonstrate its capacity and credibility. In the contemporary era, nations that participate in global trade also need to protect intellectual property to attract foreign investment and to successfully serve export markets, as products shipped overseas usually need to be “legitimate.”

All these issues apply directly to China, and indeed China’s intellectual property regime has changed as China’s economy developed, though the regime is still imperfect. China passed a series of trademark, patent, and copyright laws in the 1980s, but it was after ascending to the W.T.O. in 2001 that China had to enact new laws, regulations, and processes to protect I.P. under the W.T.O.’s “Trade Related Aspects of I.P.” (T.R.I.P.s). To conform with T.R.I.P.s in the promising, and I.P. protection continued to be an issue.

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3 Scalise of the SIA, transcript, “Hearing with the U.S. Subcommittee on Trade of the Committee on Ways and Means.

4 Hatano of the SIA, statement to the Congressional-Executive Commission on China, “Is China Playing by the Rules?”


The global semiconductor industry was hopeful that China’s entry into the W.T.O. would lead to better protection of I.P. in China, though that hope was not realized at least in the short term. Certainly, China’s I.P. regime has been strengthened and expanded since 2001. China’s State Intellectual Property Office (S.I.P.O., formerly the Patent Bureau) has fifty-four branch offices, and the judges that decide patent cases became increasingly professionalized in the 2000s in handling technically complex I.P. cases.

China’s entry to the W.T.O. may have fostered its I.P.-related institutions, yet from the early 2000s to the present, problems have remained. In the early 2000s, commonly cited problems included dis-connects between intentions and policies at the central and local levels and lack of policy enforcement. Foreigners found China’s judicial system to be, generally, not transparent, not standardized, and not predictable. In the courts, some foreigners believed that due process was not entirely respected and discovery processes were weak. Further, some felt that judges were more apt to find against foreigners, and finally, monetary awards were often trifling.

Under China’s new I.P.-related laws and regulations from 2001, the Chinese government could compel I.P. holders to license their I.P., which was at odds with the W.T.O.’s T.R.I.P.s agreement. Another point of contention in China was that licensees of I.P. would own any improvements that they made to the I.P. In cases of counterfeit products, the SIA also complained in 2003 that, under China’s laws, to file claims against counterfeiters, a complainant had to track down an actual buyer of the counterfeit goods and convince the buyer to help with the case (i.e., admit to purchasing counterfeit goods.) The complainant could not hire an investigator to purchase the counterfeit goods, as claims could only be filed if there were

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7 Wang and Wang, Wo Guo Jichengdianlu Chanye, page 331. This regulation was promulgated by Decree No. 300 of the State Council of the People's Republic of China. An English-language version is available at www.sipo.gov.cn.


9 Hatano of the SIA, statement to the Congressional-Executive Commission on China, “Is China Playing by the Rules?”
“legitimate” purchases.

In light of these and other I.P.-related obstacles in China, foreign firms with design activities in China used several tactics. First, design work assigned to staff in China might be compartmentalized. That is, design staff in China might be assigned to work on narrowly defined problems, and they would not be informed as to how their work was connected to the rest of the design or program.\(^{10}\) At times, Chinese team design teams’ work was not fully electronically connected to the home country’s R&D or design center, in order to reduce unauthorized access to the larger project or other proprietary information. Another option for foreign firms was to partner with a Chinese organization in a way that gave the Chinese partner a stake in protecting I.P. (That said, foreign firms have also complained that their Chinese partners steal their I.P.) Further, foreign firms typically did not conduct leading edge design work in China. Rather, design work in China might be geared toward adapting products to the local market or serving local customers with design support. Despite these cautious tactics, when semiconductor I.P. was infringed in China, foreign firms often did not file complaints in China owing to the problems discussed above. Rather, foreign firms would file in their home countries.

And, despite foreign firms’ caution, there were a number of ways that semiconductor I.P. was increasingly infringed from 1997 to 2003 and beyond. Generally, China’s programs for inward-bound technology transfer created opportunities for potential infringers to gain access to trade secrets and patented technology and products. In a similar way, the de-verticalization of the semiconductor industry caused more inter-firm sharing of information and technology. Further, Chinese partners sometimes licensed patents from their joint venture partners, but then illicitly disclosed the I.P. to outside parties. Of course, as semiconductor personnel moved between companies in China, trade secrets as well as patents could be compromised, as occurred at SMIC, one of China’s national champion semiconductor enterprises.\(^{11}\)

Semiconductor chips can be copied in two main ways. First, a counterfeiter can optically copy a chip to create an identical chip, and then the copied chip is branded and sold under a different company name. Another way to copy a chip is to reverse engineer the chip, produce an

\(^{10}\) PwC, “Redefining Intellectual Property Value: The Case of China,” 2005, page 59. I saw a similar phenomenon in defense-related engineering work at Texas Instruments. Individuals and groups were not always informed about how their project served a much larger project.

\(^{11}\) See Chapter Four, Section 4.34.
exact copy, and then fraudulently sell the copied chip under the original owner’s brand name.\textsuperscript{12} In one famous case in 2003, a professor at Shanghai’s Jiaotong University allegedly developed China’s first digital signal processing chip, called the “Haxin Chip.” Yet, in 2006, an investigation showed that the chip was actually a copy of a Motorola chip, with identifying marks removed. The Chinese government investigated the professor, and he was banned from research and made to return funds.\textsuperscript{13} In a 2004 case, several Chinese chip manufacturers including Shanghai Belling (one of China’s five key semiconductor enterprises and joint venture partner of Alcatel Bell) were found to be manufacturing and selling a counterfeit chip. Analog Devices of the U.S. was the original owner of the copied chip design. Analog was able to get an injunction against Belling and the other Chinese manufacturers in the U.S. and did not file suit in China.\textsuperscript{14}

In the early and mid 2000s, foreign firms believed that they also incurred losses through Chinese firms’ patent filings. The annual number of patents filed in China across all industries quadrupled between the late 1990s and 2005, owing to the development of China’s I.P. regime.\textsuperscript{15} However, more than two-thirds of patents filed by Chinese firms and individuals were utility model patents or design patents, rather than the more substantive invention patents. Some utility and design model patents were referred to as “petty” or “junk” patents. These were awarded more for minor changes or improvements, and the patents were granted without a full examination.\textsuperscript{16} This meant that Chinese firms could get patents on items that were in large part copies of others’ work. Between 2000 and 2010, foreign firms increasingly filed for patents in China, but about eighty percent of foreign patent applications were for the more rigorously examined invention patents.\textsuperscript{17} Foreign firms’ I.P. was also devalued when Chinese firms would

\begin{itemize}
\item \textsuperscript{12} Hatano of the SIA, statement to the Congressional-Executive Commission on China, “Is China Playing by the Rules?” For obvious reasons, semiconductor companies do not provide detailed information about how their designs are copied.
\item \textsuperscript{13} David Barboza, “In a Scientist's Fall, China Feels Robbed of Glory,” \textit{New York Times}, May 15, 2006.
\item \textsuperscript{14} PwC, “China’s Impact,” 2004, page 50.
\item \textsuperscript{15} Annual patents filed in China grew from approximately 83,000 in 1995 to 170,000 in 2000 to 475,000 in 2005 to 980,000 in 2009. Joanna Wu, I.P. attorney at Ropes and Gray, “Recent Patent Developments in China,” conference presentation at “China Scope in NYC,” March 2011.
\item \textsuperscript{17} Wu, I.P. attorney at Ropes and Gray, “Recent Patent Developments in China.”
\end{itemize}
sell copies or counterfeit products in countries in which the original foreign owner of the I.P. had not yet filed a patent. In these ways, the growth of China’s I.P. regime and the increasing use of patents in China led to loopholes and abuses.

In the semiconductor industry, there is another major area of I.P. beyond the I.P. of completed chips. From the 1990s, semiconductor design firms have increasingly relied on complex and expensive E.D.A. (electronic design automation) software systems and I.P. cores to design chips. E.D.A. software is very expensive and must be licensed; unlike off-the-shelf consumer software, E.D.A. software systems are not readily copied and circulated. I.P. “cores” refer to standard design modules that are licensed by firms like ARM, Cadence, and Synopsis. These I.P. cores are also better controlled than typical software products. Both E.D.A. and I.P. cores are licensed to users, and for example, China’s national I.C. design bases (the “7+1” bases) obtained proper licenses for E.D.A. tools for the small firms on their base to legally use and in 2003 the Shanghai Silicon Intellectual Property Exchange was founded which offers databases of I.P. for licensing, design verification, other I.P.-related services. By 2010, 7.4 percent of worldwide license revenues for E.D.A. software and 8.0 percent of worldwide license revenues for semiconductor I.P. including I.P. cores were in China. That is, firms in China were purchasing such licenses.18 The controlled use and licensing of such tools brings visibility and proper usage to I.P. in the semiconductor design sector.

Despite I.P. infringements encountered in China, foreign semiconductor firms did opt to establish operations in China, although their advanced design work was not conducted in China. It is difficult to estimate how many more firms might have come to China, or come earlier, or brought more substantial operations to China had China’s I.P. regime been more robust in the 1980s, 1990s, and 2000s. In 2005, CSIA and CCID identified 100 foreign design organizations in China. PwC was only able to identify 63 of these, but the 63 were from the world’s 200 largest semiconductor firms, and they included design units for 18 of the world’s 25 largest semiconductor firms. Given the numbers and the stature of these foreign firms, it seems that many foreign firms were willing to manage the risks of operating in China’s still-developing legal environment.19

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More broadly, Chinese views of economic development and the role of I.P. have differed from those in the West. Contemporary China could be categorized as a developmental state rather than a regulatory state. That is, the Chinese government is directly involved in investing in particular industries and technologies, with the goal of economic development and moving Chinese industries into higher value added activities. Thus, the government has enacted plans and policies to support “indigenous innovation” and (Chinese owned) I.P. In contrast, in a regulatory state like the U.S., innovation is assumed to be mostly a matter for private industry, and the government’s role is to provide a functioning legal system in which property rights are bestowed and protected. However, in China, in thinking about fostering innovation and I.P., Chinese officials consider not just individual property rights but also the public good. Some I.P. might serve China’s national interests and development, and thus the Chinese government supports the industries, technologies, and global partnering that might create I.P. for the public good and enable China to “contribute more to world innovation.” For example, the Chinese government has supported China’s state owned large enterprise groups in pursuing certain technologies and related I.P. (At the same time, high-pressure governmental goals for economic growth have also likely contributed to economic shortcuts in China, including I.P. abuses.) In the semiconductor industry, Chinese leaders see technological advances as not only serving electronics-related needs but also as improving energy efficiency and energy usage across society. Power and energy consumption are global issues, and as semiconductors can serve to reduce energy use, Chinese officials see semiconductor advances as advancing the public good.


22 Of course, the government in regulatory states typically do support I.P. development through universities, defense spending, national institutes, industry subsidies, etc.

23 There is a history in China of considering the public good aspects of intellectual property. See Alford, To Steal a Book.

24 Interview with Ye Tianchun, July 3, 2009, at the Chinese Academy of Science, Institute of Microelectronics in Beijing. Ye is the Director of the Microelectronics Institute and an advisor on national semiconductor industry policies. Dr. Ye noted that China actively looks for foreign partners to meet its medium and long-term R&D priorities.

25 Wang and Wang, Wo Guo Jichengdianlu Chanye, Introduction and Section 2.2.3. Improved semiconductor technologies result in energy savings. “Smart” energy solutions have semiconductors (often sensors) to measure variables (such as temperature) and power management functions to moderate energy usage accordingly. According to the American Council for an Energy-Efficient Economy, there is a “powerful connection between semiconductors and energy consumption… Despite the immediate growth in electricity
(In contrast, some U.S. observers view the Chinese government’s goals for indigenous innovation as nefarious and nationalistic.)

Given China’s perspective on the role of I.P., there is also a concern by Chinese officials that Western countries use I.P. to dominate less developed countries. In this view, I.P. rights not only motivate innovation and protect intangible assets, but these rights are used strategically by companies for “demonstrating value to potential investors, deterring competitors, and capturing value from rival firms” via legal actions and “to prevail in competition and to maximize value.”

In a study entitled “China’s I.P. Transition,” Richard Suttmeier and Xiangkui Yao argue that “Many Chinese observers, while genuinely lamenting the problems of piracy and counterfeiting, nevertheless lack sympathy for some complaints about Chinese I.P. protection by foreign companies and governments. They point, instead, to the fact that many foreign companies have adopted quite well to Chinese conditions and use their I.P. with strategic success for profits and competitive advantage.” Indeed, global companies do adopt specific strategies and programs to maximize the value their I.P.

China’s government has its own macro perspective on the role of innovation and I.P., and Chinese individuals and firms also seem to have particular views on these matters. Chinese electronics personnel express pride in the ability of Chinese companies to imitate – and even improve upon – advanced, Western electronics products, such as cell phones. They appreciate “follower” products, as these products demonstrate evolution in Chinese firms’ capabilities. The Western business perspective on follower products is often dismissive (or disdainful, due to I.P. infringement), but there is a huge market for follower products. Non-leading firms consider themselves successful when they are able to develop, produce, and market viable (follower)

demands to power the growing number of devices and technologies, semiconductors [enable] a surprisingly larger energy productivity benefit…”

26 Foreign observers lament I.P. infringement in China, while also lamenting the desire of the Chinese government to support the development of legitimate I.P. There are many examples of foreign critiques of China’s policies for indigenous innovation, but for example, see USITR, “China: Intellectual Property Infringement, Indigenous Innovation Policies, and Frameworks for Measuring the Effects on the U.S. Economy,” Number 332-514, Publication 4199, November 2010.


products, although these voices are not typically heard in Western business case studies.\textsuperscript{29} For non-leading firms, gradual improvements in organization, management, and technology are often incremental and not overtly innovative by Western standards.

In sum, I.P. norms and protection in China are still insufficient by Western standards. This situation will likely not change in the short term owing to the gradual development of China’s legal system and I.P. regime, the Chinese government’s “public good” considerations with regard to I.P., and Chinese business people’s acceptance of follower products. Despite the seemingly slow pace of change with regard to I.P. protection in China, the global semiconductor industry made significant commitments to locate operations in China in the 1990s and 2000s.

\textsuperscript{29} Interviews including Yang Long, Mr. Jiang (WXICC), Toby Chai, Huang Qi, Xu Guochang, Mr. Gong, and Yu Xiekang. See the Interview List for details on dates and organizations. Others expressed similar views.