

THE CHANGING FACE OF INNOVATION IN CHINA

FOREIGN COMPANIES MUST RETOOL THEIR R&D STRATEGIES TO KEEP PACE WITH NEWLY INNOVATIVE CHINESE ENTERPRISES.

BY DAN PRUD'HOMME AND MAX VON ZEDTWITZ

THE ART OF *bian lian* — or “face changing” — is integral to Sichuan opera: A main character changes masks to avoid capture by foes. The transformation is quick and surprising, the new face clearly different. In the theater of business, Chinese performers are undergoing a rapid transformation of their own as they seek to evolve from backroom producers to the world's leading face of innovation.

Over the past five years, domestic Chinese companies have been innovating unlike ever before. In 2016, the National Supercomputing Center in Wuxi, China, unveiled the Sunway TaihuLight, the world's fastest supercomputer, with 10.65 million CPU cores. Meanwhile, Chinese company Ehang Inc., based in Guangzhou, launched the world's first aerial passenger drone, the Ehang 184, capable of autonomously transporting a person in the air for 23 minutes. These feats of Chinese ingenuity join many other recent innovations in a range of industries. Western companies beware: This is not the China you are accustomed to, and the ramifications for your research and development strategies may be profound.

For much of the last two decades, foreign innovation in China has been driven by competition among foreign companies and by imitative threats from local Chinese companies.¹ R&D has generally been managed according to the following paradigm: Foreign R&D competes against other foreign R&D in higher-end market segments, while Chinese companies operate in lower-end market segments, often competing only indirectly with foreign R&D.²



THE LEADING QUESTION

How should foreign companies react to increasingly innovative Chinese companies?

FINDINGS

- ▶ Consider quicker patenting for China R&D.
- ▶ Engage in leading-edge innovation in China when returns exceed global risks.
- ▶ Eliminate barriers to faster time to market.
- ▶ Better balance localization and the growing liability of foreignness.



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ABOUT THE RESEARCH

Our research draws on more than 200 semistructured interviews we conducted with R&D and innovation executives from more than 60 foreign companies operating in China. The representatives were almost equally split between European and U.S. companies, and they also included executives from Japanese and Canadian companies. The companies came from a wide range of industries, including energy, materials, capital goods, transportation, automobiles, machine tools, consumer durables, retail, food and beverage, health care, finance, software, and telecommunications. Our interviews were conducted primarily in Beijing and Shanghai.

In our interviews, we explored how rising Chinese innovation capabilities are posing new challenges to foreign R&D management. We discovered five new challenges to managing R&D in China.

Moreover, many have long been skeptical about the ability of China's ecosystem, especially its political, cultural, educational, and financial institutions, to foster genuine indigenous innovation. Many foreign companies we have spoken to over the years have admitted to contributing to this narrative, in part hoping that it would become a self-fulfilling prophecy.

However, the face of the Chinese competitor has visibly changed in the past five years due to a variety of factors. Years of foreign investments have allowed China to develop into a manufacturing powerhouse rich in technological learning opportunities for local companies. Leaders among these companies have moved up the capabilities ladder from producers to creators. Chinese innovation is visible in internet business models, telecommunications, software, artificial intelligence, fintech (financial technology), new materials, consumer products, high-end equipment, and green technologies.³ Innovative Chinese companies such as Huawei, ZTE, Alibaba, and Baidu are becoming household names outside China. And other Chinese companies are innovating in science and engineering — for instance, BGI, a biotech company based in Shenzhen that is the world's largest provider of genome sequencing services, and DJI, a technology and engineering company, also based in Shenzhen, that specializes in drones.⁴

Foreign companies are starting to recognize these changes. In a 2014 survey, two-thirds of foreign executives said that Chinese companies are “just as innovative or more innovative” than their own companies.⁵ And Chinese companies lagging behind are catching up: A 2017 survey found that 60% of European companies in China expect domestic competitors to close the innovation gap with them by 2020.⁶ These changes have serious implications for the way foreign companies manage their China R&D.

The New Challenges to Managing Foreign R&D in China

Given these new conditions, our research uncovered five challenges to managing foreign R&D in China. (See “About the Research.”)

1. In recruiting, foreignness is becoming a liability. Foreign brand reputation used to provide multinational corporations (MNCs) with

recruitment advantages. But according to a 2017 survey, only 18% of Chinese university students want to work for a foreign company.⁷ This is down substantially from 38% in 2013 and more than 70% in 2008.⁸

R&D positions at Chinese tech companies are more attractive than ever partially *because* the companies are Chinese. As symbols of Chinese prosperity, prestige, and ingenuity, it is not surprising that they are attracting more Chinese R&D staff, both from home and abroad.

Our interviews indicate that the increasing movements of Chinese R&D staff may also be a product of imperfect localization attempts by foreign MNCs. Some MNCs have adopted culturally sensitive strategies to manage local staff (for example, designing R&D centers according to *feng shui* principles and ensuring local staff work in groups to mitigate the cultural fear of failure). However, many still have not adequately localized their management approach, both in quantity and — more importantly — in quality of local R&D leadership. While China-based directors know what their Chinese staff is capable of, our interviews indicate that some headquarters-based directors still hold the opinion that “the Chinese won't take risks, they can't innovate,” or at least prefer to keep local staff out of strategic innovation decision-making. This undermines trust between local staff and foreign R&D management.

Further, our interviews indicate that an increasing number of Chinese companies now provide their R&D staff with equal or greater benefits and opportunities compared with their foreign counterparts.⁹ For example, a skilled software engineer leaving Microsoft or Amazon can jump ship to Baidu and find him/herself in a more senior post with higher pay.¹⁰ And foreign companies are no longer the only ones that can promise an international assignment or the excitement of working on leading-edge technologies. Many Chinese companies understand how to attract high-quality local recruits and now have the resources to do so.

2. China's intellectual property (IP) regime has strengthened. Foreign companies have long pushed for stronger IP protection in China. Now, they may somewhat regret getting what they wished for. The combination of a stronger IP regime, more capable Chinese companies, and Chinese state support for

indigenous patenting poses several new challenges to how foreign companies conduct R&D.

Although certainly still subject to criticism, China's IP regime has been substantially strengthened over the last decade. And improvements are ongoing: Starting in 2014, specialized IP courts with well-trained judges have been rolled out across China, and additional changes are being made to the country's IP enforcement environment. A host of IP laws and regulations have been revised in the last five years, and many more new reforms (for example, to the patent law) are under way.

These revisions have been increasingly driven by rising Chinese innovators needing better legal appropriability.¹¹ They have also provided better appropriability for foreign companies. A direct consequence is that both foreign and Chinese companies have filed more patents in China.¹² Since 2011, China has been the world's leading filer of domestic patent applications.¹³ In 2016, a mind-boggling nearly 3.5 million patents were filed in China (1.3 million invention patents, 1.5 million utility model patents, and 650,000 design patents).¹⁴

The Chinese government is helping to manufacture this trend. The state continues to set targets for patenting (for example, the "13th Five-Year Plan for Economic and Social Development" aims for 12 invention patents to be owned per every 10,000 people in China by 2020),¹⁵ which it ties to the performance evaluations of Chinese state-owned enterprises, state-funded researchers, and government officials. A massive system of patent-related subsidies and tax breaks, some with relatively limited qualification requirements, has been rolled out to help meet targets.¹⁶ This support boosts the patent portfolios of local companies, universities, and public research institutes.

The rise in patenting in China has placed foreign companies in a new type of patent race for "freedom to operate" — that is, the ability to develop and use a technology without infringing on the rights of others. These races especially drive patenting and patent licensing in industries such as information and communications technology, where knowledge is highly cumulative — hence the incredible numbers of patents being generated by Huawei, ZTE, and Qualcomm.

The number of IP infringement disputes has rocketed alongside this explosion in patenting:

China now leads the world in the number of IP civil cases filed in court. In 2016, Chinese courts handled a record 152,072 cases.¹⁷

Although more than 98% of IP lawsuits in China are between Chinese companies, and foreigners on average win their IP lawsuits in Chinese courts, recent increases in IP litigation in China are making foreign companies we talked with reevaluate how they operate. The more often that big rulings emerge, the more foreign companies realize that IP litigation in China can be a high-stakes game. In 2016, \$7.5 million was awarded to Beijing Watchdata Systems Co. for Hengbao Co. Ltd.'s infringement of its USB key patent, the highest damages ever in a patent infringement case involving a Chinese plaintiff and a Chinese defendant. This builds on the largest IP infringement case in Chinese history, which involves foreign parties: the \$60 million mediation settlement in 2012 in favor of Proview Technology (Shenzhen) Co. Ltd. against Apple Inc.

Additionally, rising patent invalidation cases in China portend new challenges: Some are in response to low-quality rights being filed by local companies, and some require foreign companies to be on the defensive. Such cases continue to increase: 3,969 patent invalidation requests were received in 2016, a 7% increase from 2015.¹⁸

China's changing patenting landscape challenges the traditional foreign R&D management model. R&D departments are no longer primarily tasked with inventing around foreign technology. Foreign R&D departments need to more seriously invent around existing Chinese technologies, as well as predict their trajectories and plan future R&D accordingly.

3. Keeping advanced technology away from China comes with greater risks, but so does sharing it. Generally speaking, foreign companies traditionally have not transferred cutting-edge technology to China and conducted R&D on it there.¹⁹ These steps have been reserved for markets with more developed legal regimes for commerce and more sophisticated competition. Instead, MNCs generally relied on technology they created outside China to compete with foreign counterparts in China. However, rising Chinese innovation capabilities now make this strategy increasingly risky.

As foreign MNCs find their incumbent advantages eroded by newcomer Chinese companies and

face more demanding local consumers, our foreign interviewees often mentioned that they feel pressure to conduct more sophisticated R&D in China today.

Smarter state policies in emerging industries add another layer of complexity to this calculus, as seen in the trajectory of the new energy vehicle (NEV) industry. Since late 2009, the Chinese state has released a range of policies (most recently in 2017) in the NEV industry designed to pressure foreign companies to transfer frontier technology to foreign-Sino joint ventures (JVs). The policies require that foreign companies wanting to obtain manufacturing licenses and to access government procurement and subsidies for NEVs must first “master” development of NEV technologies within a JV with a local Chinese partner. An increasing number of local auto companies, such as BYD, Kandi, BAIC, Chery, and Geely, are advancing in China’s NEV market. Their success has pressured some Western auto sector incumbents we interviewed to comply with China’s NEV technology transfer policies. Other foreign incumbents that have not capitulated to the state policies face ongoing challenges.²⁰

The length of technological lead times is an indicator of the risks faced by foreign companies in China. Foreign companies operating in extremely R&D-intensive industries (for example, aircraft engines) will likely enjoy comfortable leads for some time still. But the fact remains that there is growing state and market-based pressure in various industries to transfer cutting-edge technology and conduct R&D on it in order to survive. Industries most susceptible to this pressure include several “strategic emerging industries” — for example, NEVs and next-generation information technology (IT) and some industries targeted in the “Made in China 2025” initiative, such as robotics.²¹

At the same time, the risks of collaborating on cutting-edge technology projects with Chinese

companies are becoming more pronounced. The tale of forced technology transfer policies in the high-speed rail industry is relatively well-known: Starting in 2004, the Chinese Ministry of Railways tendered for bids to produce high-speed train sets, requiring successful bidders to transfer advanced technology to its Chinese JV partners, China Northern Locomotive & Rolling Stock Industry (Group) Corp. (CNR) and China South Locomotive & Rolling Stock Corp. Ltd. (CSR). However, the effects of the resulting deals on the foreign companies such as Siemens, Alstom, and Kawasaki²² that participated in these deals have not been fully realized until recently. CRRC Corp. Ltd., a juggernaut Chinese rolling stock manufacturer resulting from the 2015 merger of CNR and CSR, now holds more global market share in that industry than both Siemens and Alstom combined. And CRRC continues to win contracts globally. In a scramble to compete, Siemens’ train-making arm agreed to merge with Alstom in September 2017, while Kawasaki saw its competitiveness eroded by CSR even sooner after transferring technology to that company. This highlights the dangers of collaborating with Chinese companies that are supported by the state, learn quickly, upgrade their technological capabilities, and have an uncanny ability to quickly scale up operations.

As the technological capabilities of Chinese companies advance and the Chinese state learns from its past experiments, foreign companies face a serious dilemma: Should they transfer advanced technology and conduct more R&D in China now, sometimes in suboptimal conditions, or lose market share and potentially get left behind? Increasing investment in leading-edge operations makes foreign companies more economically embedded in — and dependent on — the Chinese market. This potentially weakens their independence and inadvertently makes them more malleable by Chinese policymakers. More than



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ever, foreign companies must grapple with these issues when deciding the smartest direction for their R&D and how it should be managed vis-à-vis local partners-cum-competitors.

4. Innovation transaction costs can now jeopardize the lead. Foreign companies have long faced discriminatory regulations and uncertain government relations in China. Yet, they could innovate, while Chinese companies merely imitated. Now, Chinese companies also innovate while still avoiding many transaction costs that plague foreign companies.

The transparency, predictability, and fairness of China's regulatory environment (covering things such as licensing permits, certifications, and accreditations) remain among the 10 most significant challenges to foreign business in China.²³ Examples of these challenges are wide ranging and numerous. They include, among others, excessive disclosure of confidential business information as a precondition for foreign companies to obtain a license or gain other forms of regulatory approval to operate in a range of industries (for example, pharmaceuticals and chemicals); onerous requirements in some state rules and significant ambiguity in others governing foreign technology imports and technology exports; limitations on the number of foreign pharmaceutical products permitted on health care reimbursement lists; prohibition of foreign companies from unilaterally obtaining cloud computing internet data center licenses; and various subsidies and other programs supporting development of "indigenous intellectual property" and indigenous technical standards rather than foreign-created technology.

Simultaneously squeezed by rising competition from more innovative local companies, some foreign organizations find these externalities are cutting into their bottom lines in unprecedented ways. Meanwhile, some rising Chinese companies do not experience the same transaction costs because of their close relationships with local officials

or because they are otherwise championed by the state. Few, if any, of the current domestic companies leading in the Chinese market would be in their enviable positions if they had not had especially good connections to the government. This is an advantage that foreign companies cannot fully replicate, often only hoping to approximate it by engaging local Chinese companies (or universities or research institutes) as partners.

MNCs have responded in various ways. Some have diversified investments away from China. Some have formulated new messages for the Chinese government, criticizing policymakers for "promise fatigue" — that is, unmet promises to tackle unfair trading conditions.²⁴ Our interviews indicate that more and more foreign companies task their China-based R&D departments with maintaining their increasingly tenuous positions in the Chinese market.

5. Time to market (TTM) of innovative products and services is more important than ever. Chinese companies currently achieve lightning-fast TTM of innovative products and services, as their structures enable high responsiveness locally. This is especially important in a market where the customers are as fickle as they are in China. Much of this dynamism is owed to Chinese companies' rising technological capabilities, flexible quality assurance, hierarchical structures with fewer processes, and less emphasis on work-life balance.²⁵

Meanwhile, a culture of overengineering products, stringent quality standards, and strict internal processes is costing some foreign companies time that they can no longer afford. This behavior may be more ingrained in certain European companies than in those from the U.S., but it is still a challenge faced by many companies from both regions.

Many of our interviewees in the information and communication technologies and consumer electronics sectors emphasized the increasing

importance of TTM to keep up with increasingly innovative local competitors. There are similar trends in the pharmaceuticals, medical, and industrial equipment industries.²⁶

Compounding these challenges is the threat of cannibalizing existing product offerings. Although the innovations currently generated by most Chinese competitors are usually not yet breakthroughs, they are “good enough” for the Chinese market and are usually well suited to local consumers’ tastes and pocketbooks. Local competitors have even been able to convince high-end Chinese customers to trade down for what are perceived as better-value products.²⁷ As such, many foreign companies must now decide whether to innovate for fast-moving, lower-end market segments, realizing it may cannibalize their hold on high-end market segments.²⁸ At the same time, some foreign companies will need to decide if they should risk further cannibalizing existing product offerings by engaging in even more advanced innovation in emerging technologies where Chinese companies threaten to leapfrog incumbents.

Managing R&D in China Differently

In the face of these challenges, foreign companies in China will need to manage innovation quite differently. Here are the main steps we believe that foreign companies should take.

Strike a better balance between localization and the growing liability of foreignness. Foreign R&D and technology managers bring a wealth of experience and vision to local R&D centers in China, and they should continue to play an integral role in China R&D. At the same time, foreign companies need to ensure that they have adequate local faces in management positions within and outside the lab. They cannot afford R&D glass ceilings when it appears that the sky is the limit at Chinese competitors. Additionally, stereotyping and false perceptions about the inherent ability of the Chinese to innovate should not be tolerated. This may require a reorientation of company culture starting at headquarters. Some foreign companies will also have to reinvent themselves to make their foreignness more alluring but their local R&D management style better suited to Chinese sensitivities.

Speed up patenting when keeping trade secrets is not strategic.²⁹ Keeping up in the patent races requires foreign R&D be geared toward producing inventions that are patentable in China and abroad. And, more than ever, the trajectories of indigenous Chinese patenting must be taken into consideration.

Further, this must often be done faster and at a larger scale. It will require filing even more invention patents more quickly. It may require filing patents on sometimes less substantive R&D outcomes than patent attorneys are used to dealing with. Quite a few foreign companies we talked with have finally realized the strategic value of “utility model” patents in China, even though those rights do not exist in the United States or a number of other nations.³⁰ And some companies will need to file more design rights on R&D outcomes.

In light of these changes, R&D and IP management competencies should be well integrated within companies. Some foreign technology subsidiaries in China still manage IP and R&D in silos, which can limit the responsiveness of their organizations to the fast-changing innovation capabilities and increasingly strategic use of IP by local competitors. Better communication, for example through structural changes in the organization of R&D and IP management functions, can help improve a company’s dynamism.

Engage in cutting-edge innovation in China when returns exceed global risks. Getting this right requires an updated risk-vs.-reward assessment and a globally minded management strategy accounting for the new capabilities of Chinese competitors and collaborators and the Chinese state.

Companies operating in China, as in other countries, face many risks of getting innovation wrong. But, unlike in more developed countries, foreign companies in China face the challenge of having to conduct more advanced innovation in a potentially riskier policy and legal regime. This means that foreign companies’ innovation risks in China fundamentally depend on their modes of operation.

Whichever innovation mode of operation a company chooses, it should follow the strategies mentioned elsewhere in this article to capture returns on its China investments. But foreign companies facing Chinese government policies requiring transfer of more advanced technology to

local counterparts need to think even bigger. They should engage in these operations only if they are confident that their global operations can quickly and effectively respond to the strong Chinese competitors they may help create. This requires both a strong global innovation strategy (for example, doubling down on promising R&D projects outside China and speeding up R&D outside China) and a complementary business strategy (for example, strategically patenting, engaging in more mergers and acquisitions in China and abroad, seeking greater support from home governments, and possibly shifting away from product lines increasingly dominated by Chinese companies).

Although there are plenty of cases of companies getting this calculus wrong, there are prominent examples of those getting it right. Microsoft Corp.'s experience is illustrative. In an effort to take fuller advantage of innovation opportunities in China, the company established a research and fundamental technology development center in Beijing in the late 1990s. The center is now one of Microsoft's most productive and competent centers worldwide in terms of scientific publications, patent filings, and invention disclosures.

Focus talent, culture, and operations toward faster time to market. Although there are limitations to the structures of many Chinese companies (for example, they are difficult to roll out as they go abroad), they nonetheless enable high responsiveness in China. Foreign companies need to learn from Chinese competitors' adeptness in "good-enough" innovation coupled with lightning-fast TTM. Companies should weight TTM more heavily in R&D staff's performance evaluation criteria. This should be coupled with a systematic review of culture and processes that results in trimming away unnecessary barriers to faster TTM, from ideation to commercialization.

Foreign companies should more confidently tap into the entrepreneurial qualities of their Chinese operations. Some of our interviewees have successfully launched small-batch-minimum viable products to curtail overengineering and accelerated learning from customer feedback. To avoid possible reputation backlash from a higher market fault rate, these launches were undertaken by special-purpose nonbranded startups. In the case of

Intel Corp., one of the world's largest microprocessor companies, shortened decision paths and faster experimentation cycles helped accelerate the final ramp-up and introduction of new products from six months to less than four weeks.

The Art of Face Changing

Supercomputers, unmanned aerial drones, and many innovations in between: These are the new faces of Chinese performers. Although the prescription we offer in response is not always simple to fill, Western approaches to China-based R&D must transform alongside this new face of Chinese innovation. And while there are clearly strong elements of defensive strategy in play here, there is also great offensive opportunity. As foreign companies emulate Chinese nimbleness, they will be building skills they can transfer back to their own headquarters and to other subsidiaries outside China. Rising to the new challenges of R&D in China opens companies to engage in their own form of reverse innovation and to globalize a new, more flexible set of innovation capabilities.³¹

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