

How China innovates

Run of the Red Queen

by Dan Breznitz and Michael Murphree

“Well, in our country,” said Alice, still panting a little, “you’d generally get to somewhere else – if you run very fast for a long time, as we’ve been doing.”

“A slow sort of country!” said the Red Queen. “Now, here, you see, it takes all the running you can do, to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that!”

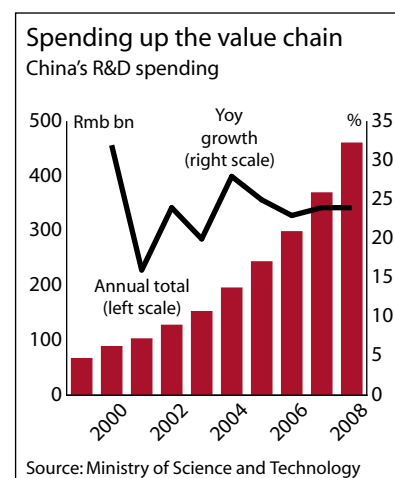
– Lewis Carroll, *Through the Looking-Glass*

China’s leaders believe that mastering innovation is the key to securing long-term economic growth and, therefore, enhancing national welfare. Yet Beijing’s drive to boost China’s innovative capacity is founded on two interlinked myths. First, that novel-product innovation – defined narrowly as the creation of *new* technologies, services and products – is the holy grail of sustainable economic growth. Second, that China must imitate the novel-product-innovation model of Silicon Valley or face economic decline. In truth, China is already a world leader in second-generation, process and production innovation. Furthermore, changes in the global production of products and services mean this system of innovation can continue to thrive for many years, driving China’s rapid economic growth with it.

China’s innovative edge lies much closer to D than to R on the R&D spectrum: China’s companies remain better at developing and improving existing products than at inventing new ones. Like the Red Queen in Lewis Carroll’s *Through the Looking-Glass*, Chinese technology companies run as fast as they can to remain in the same spot. They shine by developing quickly enough to remain at the cusp of the global technology frontier without actually advancing the frontier itself. Thanks to their position at the center of the fragmented global manufacturing process, many Chinese companies excel in a wide array of secondary innovative activities, and these create significant economic value for the nation. The corollary is that policy makers need to rethink what innovation means and adjust national indigenous innovation strategies accordingly. Where the goal is national economic growth and job creation, emphasizing novelty may not be the best strategy.

Indeed, forcing Chinese firms into novel-product innovation by government fiat risks harming economic growth. Imposing foreign business models on Chinese companies – such as the Silicon Valley

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Policy makers need to rethink innovation strategies

model, which relies on a combination of cutting-edge innovation and deep pools of venture capital – may prevent some companies from pursuing profitable activities and condemn others to business strategies that make little sense in the Chinese market. A clear example of the negative consequences of government interference can be seen in Guangdong’s Pearl River Delta, where companies reaching the global technological edge in industries deemed as “sunset” by the central government (such as batteries used in uninterruptible power supply products) are effectively barred from the formal financial system.

Innovation with Chinese characteristics

In our era of fragmented production – where different countries and regions specialize not only in specific industries but in particular stages of production within specific industries, and where truly novel products are produced globally without being made in their “home” country – many modes of innovation create sustainable national economic growth. Take Apple, probably the most successful electronics firm of the past decade. It barely engages in the production of its most popular products (even most of the design for the iPod, iPhone and iPad was bought as an outsourced service). Components are manufactured in discrete stages in different locations, before being snapped together in factories around the world – most notably in Taiwanese electronics maker Foxconn’s massive export-processing plants in Shenzhen. Certainly, Apple retains the intellectual property rights to these products and, therefore, receives the bulk of the profits. But the greatest number of jobs – factory line workers, industrial designers, logistics engineers – accrue not in the United States but in China.

As China has become the global center for many different stages of production, it has developed a formidable competitive capacity to innovate in different segments of the research, development and production chain. These are as critical for broad-based economic growth – perhaps more so – as many novel-product innovations. China’s national model involves mastering second-generation innovation, including the mixing of established technologies and products to come up with new solutions, plus organizational and process innovation.

As new technological advances are made worldwide, China is becoming an important location for secondary innovations building upon these discoveries. Chinese policy makers tend to view the fact that new inventions come from foreign multinationals and laboratories overseas, rather than homegrown sources, as a weakness. But it is important to remember that these same multinationals would not be able to produce and stay profitable without China. In a world of fragmented production, HP, Apple and Cisco would find it extremely difficult to operate without their Chinese partners. And in the same way, their Chinese partners would find it difficult to operate without them – a true interdependency. Although the profit distribution is uneven, so is the distribution of jobs created and destroyed. It is not clear what should be more valued from a national per-



China remains weak at novel-product innovation but is a major location for secondary innovation

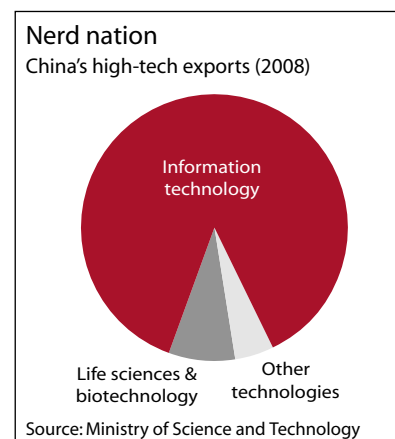
spective, nor is it clear whether it is profits or jobs that do more to secure long-term prosperity.

Local entrepreneurship drives innovation

China's Run of the Red Queen innovation model largely developed by accident. Unlike the state-led export-promotion models of Japan and South Korea, China's innovation policy has never been coordinated by a powerful central government ministry. Rather, the central government created space for reform, and local governments responded as they saw fit. The center only decided what models to support and which to jettison after seeing the results of this local experimentation. Some initiatives, such as encouraging export promotion in the Pearl River Delta, were emulated across China. Others, such as the development of joint ventures that enabled foreign companies to participate in the roll-out of telecommunications infrastructure, were subsequently banned. The development trajectory of Chinese industry depended on transferring responsibility for the bulk of innovation away from the conservative center to localities, while leaving the center firmly in control of a few key areas crucial for novel-product innovation, such as the financial system and basic research. This transfer of responsibility was necessary to shake off the inefficient top-down innovation system established in the 1950s.

China's localities shy away from novel-product innovation largely because of constraints stemming from central government control. First and foremost, since local officials know that economic growth is the key to political advancement, they pour their efforts and capital into short-term projects and proven technologies rather than long-term, uncertain primary research. China's capricious policy environment, moreover, means that would-be entrepreneurs in high-technology industries also pursue low risks, short time horizons and quick returns – the exact opposite required for novel-product R&D. Second, enterprises that do wish to conduct serious R&D are constrained by China's financial system, which privileges large-scale state-owned or state-connected firms at the expense of smaller startups. This is compounded by a venture capital industry that, thanks to financial regulations that make it difficult to exit from an investment, is rarely interested in providing early-stage financing. Consequently entrepreneurs must quickly secure revenue sources and are unable to finance long-term novel-product R&D.

Instead, localities excel in perfecting innovation in the production and adaptation of technologies developed elsewhere. This trajectory of industrial R&D is now so firmly rooted that changing it would almost certainly have detrimental economic consequences. This is not to say China should not invest in primary research – on the contrary. But forcing structural changes on a successful, complex system for the sole reason that alternative arrangements worked for other countries may destroy China's competitive advantage while failing to deliver a workable replacement. China's strength in secondary innovation serves it well, partly because the nature of technological innovation has substantially



Abandoning China's focus on second-generation innovation would almost certainly damage the economy

Innovation in three regional flavors

The best example of China's Run of the Red Queen development model is its IT industry. We interviewed 209 representatives in China's three major IT centers, Beijing, Shanghai and the Pearl River Delta, which together account for one-third of China's annual research spending and 60% of high-tech exports. We found that each region created a distinct development path, supporting our view that successful innovation in China is driven by local comparative advantage, not central planning.

Beijing is a city of startups, state research labs and R&D-based enterprises (both foreign and domestic). Its IT enterprises are built on China's strongest human and educational resources. The capital is home to several top universities, producing nearly 150,000 university graduates and 56,000 Masters and PhD graduates annually. It also houses 38 of 105 research branches of the Chinese Academy of Sciences, China's premier research institution.

Yet few firms attempt genuine primary research, instead innovating around later stages of product development or adapting foreign business models and technologies, such as internet search engines. Beijing's R&D-intensive business models rely on outsourcing production to the Yangtze and Pearl River Deltas, making its companies a guiding force in technology manufacturing across China.

Lenovo and Techfaith are two companies representative of Beijing's innovation capabilities. Lenovo, the world's fourth largest producer of PCs and laptop computers, attained international fame when it purchased IBM's PC division in 2005. Instead of focusing on high-end technology, it adapted its basic computer models and production chain to the Chinese market, making computers affordable for the urban masses. Techfaith, a Nasdaq-listed mobile phone design company established by former employees of Motorola's Beijing R&D center, designs handsets for foreign mobile operators and prestige luxury brands, such as Gucci. It does not make phones, instead outsourcing to contract manufacturers in south China.

Shanghai's industrial infrastructure, dominated by state conglomerates and big foreign investors, helped it become the center of China's semiconductor fabrication industry. It has rich human resources, thanks to a large university system and its ability to attract foreign talent. But the purposeful dispersion of university campuses and industrial zones far from the urban core blunts its ability to act as an incubator of startups. An activist local planning authority attempts to force enterprises to conform to a planned vision for the city's development, restricting the impact of market forces and making Shanghai function much like a developmental state.

Shanghai's love of large conglomerates and its open approach toward multinationals is apparent at Shanghai Bell, a joint venture between Alcatel and Shanghai Post and Telecommunications Industrial Corporation. Since the 1980s, it has been one of China's biggest makers of telecom switches. Ostensibly a joint venture, it has operated as an independent Chinese incorporated firm since 2002, and its Chinese state partners exert a great degree of influence. It combines the best of Shanghai's manufacturing prowess with R&D, and employs over 1,600 researchers.

Semiconductor Manufacturing International Corporation (SMIC), the biggest player in the semiconductor industry, shares similarities with Shanghai Bell. Originally a private enterprise with strong Taiwanese connections, it made itself into China's largest foundry by becoming a semi state-owned enterprise. Now tightly woven into the state, it builds upon Shanghai's strengths and serves the needs of state agencies seeking to reduce their reliance on foreign production. However, its ultra-fast expansion and tight official relations may now be a liability as it struggles to maintain profit margins and market share.

The **Pearl River Delta (PRD)** built its regional innovation and industrial system out of nothing. It utilized investment from Hong Kong and overseas Chinese to build export-oriented production facilities. Many local entrepreneurs then used this industrial base to set up companies oriented toward the domestic market, conquering China's hinterland with low-cost technologies.

Shenzhen-based Tencent, China's largest and most profitable internet company, excels at second-generation innovation and building upon established foreign technologies. Its QQ instant messaging technology, originally copying Israel's ICQ, has grown into a complete value-added internet service offering chat, email, shopping, games, storage and search. Tencent uses local staff to maintain operations, while relying on the deeper talent pool in Beijing and Shanghai to expand into new business lines and technologies.

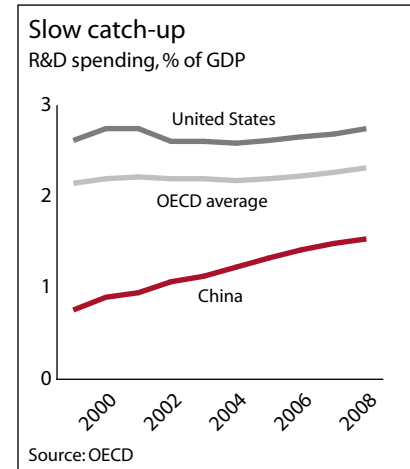
A very different strategy is apparent in hardware. In areas where foreign companies have lost interest, such as uninterruptable power supply (UPS), the PRD's IT clusters innovate through tight connections among networks of suppliers, SMEs and the large manufacturers which buy their output. Local UPS firms have steadily upgraded their capabilities in system-control software, digital interfaces, production and batteries to approach the global standard. These firms, which often work as contract manufacturers for international brands but use their own brand names domestically, have become crucial to China's foray into industries such as space and aeronautics.

changed over the past 20 years. Whereas South Korea relied on national champions to master every stage of production, today's globally successful Chinese IT companies such as Inspur, Aigo and TechFaith Wireless specialize in specific stages of production and maintain a much tighter industrial focus. Moreover, Chinese firms frequently produce their strongest second-generation products for their own massive, and rapidly growing, internal market.

Central innovation plans miss the point

The biggest risk to China's high-technology development path is central government interference focused on building a strong "indigenous" innovative capacity. In 2007, President Hu Jintao told the 17th National Communist Party Congress that developing China's capacity for independent innovation was at "the core of our national development strategy and a crucial link in enhancing overall national strength." Liu Xielin, a dean at the Chinese Academy of Sciences, says that Beijing regards breaking up the technological monopoly of foreign multinationals and enhancing national security as more important than "market performance." Current technology standards policy shows the perils of state-led techno-nationalism. The failed imposition of the domestic Wireless Local Area Network Authentication and Privacy Infrastructure (WAPI) standard for wireless data networks in 2004 is a case in point. China's homegrown third-generation (3G) mobile standard, known as TD-SCDMA, is now a recognized international 3G standard – but technical glitches and subsequent licensing delays forced Chinese mobile carriers to wait seven years longer than their Japanese counterparts to launch their first commercial 3G services.

Our fear is that by focusing too much on producing novel-product innovation, the central government will harm a key pillar of China's sustained economic growth – second-generation production and process innovation. In time, China will come to master novel-product innovation. But instead of forcing itself to copy foreign models developed within different economic systems, China should follow its own development path. There is no urgency for China to master novel-product innovation, especially since the interdependencies fostered by the fragmented global production system make concerns over national technological security largely irrelevant. China's position at the heart of global production means that the Run of the Red Queen model of development is secure for the next decade or so. Accordingly, national policy makers should chart an innovation path that takes advantage of the impressive capabilities China has already developed, not one that fights against its competitive advantages.



If China focuses too much on novel-product innovation, it risks losing its advantage in process and production innovation