Workshop Report: The Real Great Wall: Barriers to Innovation in China

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I. AGENDA

QUESTIONS FOR DISCUSSION

1. Do you agree with our argument that a memorization-based and overly hierarchical education system, deficient intellectual property (IP) protections, and an unfavorable investment climate prevent China from developing radical innovations?

2. Some would compare innovation in China to innovation in other East Asian countries such as Japan, Singapore, Taiwan and Korea (either because of Confucianism or a record of economic reform preceding political reform). How successful are these countries at innovating? Are they relevant to the Chinese case?

3. What role will returnees and overseas Chinese play in China's economic development? How does this compare to the Indian and Israeli diasporas?

4. The Chinese government is trying to promote hybrid forms of corporate governance where shareholders hold increasing power but the Communist Party maintains ultimate control within firms. Does China need to adopt Western governance standards in order to innovate?

5. Government efforts to identify promising new technologies tend not to lead to innovation. Is the military sector an exception? Are military innovations likely to emerge out of state-sponsored efforts even in a country that does not have a strong record of innovation?

6. Have we overlooked any other factors that will influence China's ability to develop radical innovations? Are we overstating the importance of radical innovation to China's future prospects?

II. REPORT

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INNOVATION IN CHINA: A SYSTEM THAT REWARDS IMITATION

The workshop participants offered a range of opinions about the current extent of and future prospects for Chinese innovation. (b)(6) who researches trends in Chinese corporate research and development (R&D), responded skeptically to the assessment that China is not radically innovating and shows no signs of imminent change. He argued that his research shows an increase in China's domestic R&D investment, focused on labor-intensive, capital- and energy-saving innovations tailored to the Chinese advantage of cheap labor. Moreover, he asserted that the preponderance of technological developments worldwide historically have originated from imitation, for which the Chinese have demonstrated an aptitude. This does not reflect a lack of innovative potential, but rather is indicative of a system in which the returns from imitation are higher than the returns from innovation. As China continues to strengthen its intellectual property (IP) protections, he argued, opportunities and rewards for imitation will decrease, and China will transition into an environment conducive to innovation.

(b)(6) pointed out that the paper under discussion does not argue that the Chinese as Chinese are incapable of innovating, only that there are structural impediments to innovation in today's China, including barriers to the rule of law. Since China's strengthening IP protections is not inevitable, it cannot be assumed that China is guaranteed to develop the capacity to innovate. (b)(6) questioned the presence of any indicators that the structural factors in China that promote imitation over innovation are changing.

(b)(6) (b)(6) proposed the increase in Chinese patent filings as an indicator of innovation in China, explaining that Chinese firms are filing many more patent applications domestically than they are in the United States (140,000 in China versus 400-500 per year in the U.S.). raised the example of a modification to Siemens tractors that allows them to function in China's dusty terrain. However, he stopped short of arguing that the increase in China's patents reflects radical innovation. (b)(6) pointed out that Chinese patent numbers can be misleading. China recognizes three different types of patents: invention, utility model, and design. The majority of Chinese patents are design and utility model; there are still very few invention patents in the PRC.

(b)(6) explained that it is dangerous to look at China from an American perspective. He posited that Chinese innovation will follow a different path from that of the West and noted that spillovers from foreign R&D facilities could be a source of Chinese innovation. While China may never develop Western IP

standards, (b)(6) believes that it will develop limited protections to allow for innovations in certain fields. He also argued that there is a history of misinterpreting indicators of innovative potential. For example, in the 1860s, the *Economist* ran a series of articles arguing that the United States lacked innovative potential, which subsequently proved to be incorrect. (b)(6) (b)(6) pointed out that a British Parliamentary report of 1851, however, accurately forecast the United States's innovative prowess and economic rise.)

(b)(6) assessed China's innovative potential by explaining that he distinguishes among three kinds of innovative processes. First, he said, are Manhattan Project-like, government-sponsored, military-industrial endeavors, for which China has demonstrated a capacity. (b)(6) pointed to China's ability to develop a nuclear weapon in 1964, noting the relative backwardness of the Chinese economy then compared with Iran's position today.) Second (b)(6) described what he calls "Kleiner-Perkins" efforts (named after the Silicon Valley venture firm), featuring independent entrepreneurs who develop a technology in a backyard or garage. (b)(6) argued that China could be home to Kleiner-Perkins innovations without disturbing the regime, since these inventions would arise from outside, or on the margins of, the country's economic system. (b)(6) third category is the general innovative dynamism that we see in America, which China currently lacks. Acquiring this capacity would require steps that might destabilize the Chinese regime.

But (b)(6) cited the IMF's 2006 World Economic Outlook report, which showed that China's current level of per capita income is comparable to that of South Korea and Japan when they began their respective take-offs. He stressed that China's rapid growth has caused some to overlook the fact that it is still a poor country. From an economics standpoint, given China's relatively early state of development, current innovative capacity might not be an indicator of future performance.

MILITARY INNOVATION: A POSSIBLE EXCEPTION

While Chinese industries have failed to radically innovate, the defense sector provides a potential exception and source of new technologies. (b)(6) who first flagged the issue of Chinese innovation, argued that he has not seen any innovation in China and is waiting for a compelling example to convince him that China can generate new technology. In the military arena, he explained, China received significant technology from Russia in the 1950s, but this relationship was abruptly terminated during the Sino-Soviet split. Still, the PRC has continued to depend on Russian technology in areas such as engines, which the PRC has been unable to develop domestically despite several attempts. (b)(6) argued that a crucial part of innovation is acquiring the knowledge that a project can be done, and China has not even been able to succeed in many domains where they knew a technology could be created.

(b)(6) posited that space-related activities might be one area where the PRC is able to innovate (b)(6) countered that it would be beneficial to examine exactly how China developed its space program to determine whether the Chinese harnessed radical innovations or if most of the technology was developed through imports and reverse engineering. He argued that the space program is a prestige item, consistent with the Chinese tendency to attempt to appear to be innovative rather than actually to innovate. (b)(6) told an anecdote of an American submariner

who went on a tour of a Chinese submarine. He was shown a new vessel with a fresh coat of paint. It was clear that the submarine had never been to sea and was merely a show piece. (b)(6) offered a different perspective on the apparent lack of innovation in China's submarine program, explaining that the Chinese have developed hybrid nuclear submarines that combine extant technologies from other countries.)

(b)(6) suggested that the place to look for innovation might not be China's manned space program but rather its ground-based lasers; moreover, the penchant for deception revealed in (b)(6) anecdote could indicate the need for caution in evaluating the current state of Chinese military technology.

Another example of military innovation came from (b)(6) who argued that China's nuclear program is an example of an impressive innovative crash program. China exploded a nuclear weapon in 1964, only 19 years after Hiroshima and Nagasaki. (b)(6) suggested that China's dependence on Russian technology could be indicative of the "curse of forwardness," a concept inspired by Gerschenkron's argument about the advantage of backwardness. According to the "curse of forwardness" theory, path dependency, rather than innovative weakness, explains China's reliance on Soviet technology. After the Sino-Soviet split, the Chinese were too invested in Russian systems to start their own from scratch. (b)(6) offered another example from Harvard, which has been unable to adopt a university-wide email architecture despite the availability of state-of-the art technology because administrators are too invested in antiquated systems.)

(b)(6) responded that the 1964 feat is not so impressive because nuclear technology was well-known by that time, so that China's test cannot be considered a radical innovation. Moreover, China for a long time relied on liquid fueled missiles and only recently developed solid fuel, road-mobile missiles.

(b)(6) noted that it was dangerous to look at China's military program from our perspective, because the goals of Chinese planners may differ from the goals of their U.S. counterparts. For example, China has adopted a distinctive approach to navigating orbital vehicles, seeking to guarantee that returning capsules land on Chinese territory at the expense of making the most of their fuel capacity. This sacrifice would be unthinkable from a conventional American perspective but may be seen as a window onto Beijing's priorities. (b)(6) expanded that China has heavily invested to protect its missiles from destruction by an enemy force, electing to build many missiles and to hide them in the nation's interior, capitalizing on China's factor endowments of territory and manpower.

COMPARISON WITH OTHER ASIAN DRAGONS: A MIXED REPORT CARD

Another way to predict China's innovative potential is to compare its experience with that of other countries. The workshop participants offered a range of opinions about the extent to which other Asian nations are innovating and the likelihood that China will follow their paths. MIT's (b)(6) said that Japan's economic rise was shaped by the fact that the Japanese were fearful of reliance on foreign goods and thus saw learning as a national security priority. This

learning eventually drove innovation. (b)(6) suggested that Japan's story differs from China's in an important way. Where the perception of external threats shaped Japanese economic policy in the period of Japan's boom, fear of domestic unrest could be driving China's approach to development. (b)(6) concurred that the Chinese case is quite different because unlike Japan, the PRC has allowed large inflows of foreign direct investment (FDI). Therefore, China is not pursuing Japanese-style "technonationalism."

(b)(6) also contrasted the results of the two different strategies pursued by Japan and China. With regard to IP protection and education, China looks quite similar to Japan when it was at a similar stage in its development. However, Japan's innovative success depended on the Japanese government's recognition of the importance of horizontal and vertical linkages among firms and its establishment of programs to promote these linkages. (b)(6) asserted that the Chinese government has not similarly prioritized the establishment of linkages.

(b)(6) argued that China has a long history of invention, distinguishing it from both Japan and Korea. Despite developing notable technologies such as paper, gun powder and the compass, China seldom saw inventions converted into marketable applications. Drawing on David Landes, (b)(6) said that past failures were not just a function of the imperial Chinese state's incentive structures. Rather, they reflect a historic inability to develop sustainable science. (b)(6) was nonetheless critical of claims that China's traditional culture precluded critical thinking. He cited his dissertation on Chinese bureaucratic examinations, which in some periods emphasized rote memorization but in other periods asked questions that required problem-solving.

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(b)(6) asserted that the Japanese and Korean experiences are analogous to those of China. Korea is superb at imitating, and Japan excels at incremental innovation, but neither South Korea nor Japan has developed radical innovations. However, [redacted] offered a different view, agreeing that the Japanese, Korean, and Taiwanese cases resemble China's, but arguing that these other Asian countries *have* been able to innovate. Therefore, he argued that it is not China's Confucian past that is inhibiting its innovative ability; China is merely following an Asian model according to which imitation leads to innovation.

TOPICS FOR FURTHER RESEARCH

Three potential topics for further study were proposed during the workshop. The first was the role that returnees will play in China's development. (b)(6) explained that, from a business perspective, an ideal returnee would be someone who came to the U.S. for school and then stayed for a while, rather than someone who returned directly after graduation. (b)(6) compared Chinese students in the United States today with their Japanese counterparts in the 1980s and '90s, explaining that the Japanese never lingered after obtaining their degree. This was in part due to the tendency of Japanese companies to fund Japanese students' foreign education on the condition that they returned immediately. The majority of Chinese foreign students, on the other hand, remain in the U.S. after graduating. This may be changing, however. Questions for further research include, What is the source of most Chinese students' funding for study in the U.S.? Which students tend to return to the mainland? and, How do these returnees influence Chinese politics and the economy? (b)(6) in particular expressed an interest in collecting and

analyzing time-series data on the proportion of Chinese students who come to the United States and stay.

Second, the role of "party committees" inside each Chinese firm is a topic that bears study. A notable feature of China's economic liberalization is that party committees continue to play a role in non-state-owned concerns. It is unclear how much power these committees actually wield, but there have been several high-profile conflicts between party committees, shareholders, and management, with mixed results. (b)(6) told á story of a discussion with (b)(6) who explained that there is no tension between his roles as chairman of the Haier party committee and chief executive officer of the company. (b)(6) interpreted this to mean that (b)(6) high rank in the Chinese Communist Party (CCP) affords him substantial freedom to run his company. However, (b)(6) pointed out that Haier reportedly tried to move its headquarters out of Qinghai but was forbidden to do so by the CCP, suggesting that (b)(6) and the shareholders do not have complete control.

Finally, (b)(6) ecommended an examination of the efficacy of export controls in an era of economic integration. Export controls may have forced innovatively weak nations to depend on foreign sources of technology in the past, but with the dissemination of knowledge via the Internet and increasing globalization, it is hard to assess the effectiveness of export controls today. (b)(6) also suggested a study of the effects of globalization on China's intelligence capacity, since economic and other forms of integration should in theory facilitate intelligence collection efforts. (b)(6) agreed and added that the Chinese have finally discovered that most information in the United States is open and available, so that Chinese intelligence agents now invest significant resources gathering open-source data from the United States.

III. Workshop Paper Distributed in Advance: The Real Great Wall: Barriers to Innovation in China

Executive Summary

This study addresses the question of whether there are long-term impediments to technological innovation in the People's Republic of China (PRC). The ability to generate wholly new technologies – as opposed to just appropriating and adapting extant technologies from other parts of the world – may be a prerequisite for sustaining economic growth once China has exhausted the benefits of rural-urban labor migration and wages have risen. China's potential for innovation bears study for American defense planners because if China cannot innovate and the economy slows, domestic instability could ensue. At the same time, if China succeeds, not only the PRC's economy but also its defense infrastructure stands to benefit.

This monograph traces China's inability to generate new technologies to government policies designed to address the regime's legitimacy deficit through patronage and judicial manipulation. Banks tied to the regime allocate loans not solely on the basis of competitive fitness but in response to the priorities of political elites – to stifle unrest and reward loyalists. The Chinese Communist Party oversees school curriculums to cast the regime in the best light and intervenes in the legal system – again, to reward friends and punish enemies. Resultant uncertainty about the rule of law inspires low levels of interpersonal trust and a lack of confidence that ingenuity will be rewarded. All of these political and cultural conditions receive expression in China's:

- memorization-based and overly hierarchical education system;
- lack of linkages between firms in the same industry;
- deficient intellectual property protections; and
- unfavorable investment climate for non-state-owned enterprises.

The elites of Zhongnanhai favor state-centric remedies – for instance, steering state-owned firms toward investment in R&D and giving foreign companies and foreign-educated people of Chinese descent incentives to bring their expertise to the mainland. But these approaches have not proven successful in stimulating innovation. Foreigners tend to adjust to local conditions – the same conditions that hamper innovation by native firms. The experience of other countries suggests that government efforts to mastermind technology generation have largely failed. (A noteworthy exception is the defense sector. Centrally directed research has at times yielded impressive results in the United States. As Chinese defense intellectuals have expressed interest in the strategic usefulness of new military capabilities that have the potential to surprise adversaries, this is an area for further research.)

China's economy could continue to expand for the near future even without innovations, but the factors that impede the development of new technologies are factors that could jeopardize China's long-term economic health. Ironically, most, if not all, the obstacles to innovation in China are likely to endure because they are artifacts of policies that the regime considers necessary to its survival.

Recognition of the PRC's innovation deficit suggests two new ways to think about a potential U.S.-China competition. First, though Chinese efforts to steal U.S. technology have raised alarm bells, China's dependence on technology from abroad constitutes a real vulnerability – one that could be exploited by the U.S. Second, though some have reacted to China's rapid rise by recommending urgent action to derail it, if China does not overcome its innovation gap, its economy will continue to be burdened with inefficiencies and time will be on America's side in a U.S.-China competition.

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