Developing Human Capital in China – Implications for the United States

by Bhavya Lal

In its efforts to regain its *"fuqiang"* (rich and powerful) status in the world, China is transforming rapidly from a centralized and controlled Soviet-style economy to a more autonomous, entrepreneurial, and market-based one. In recent years, the Chinese government has allocated more funds for research and development (R&D), supported international collaborations in science and technology, and provided incentives for foreign investment in R&D.

The Chinese government has designed its Seventh Medium- and Long-Term Program for Science and Technology Development (2006-2020) to reflect its newly reformed vision of addressing the research needs of a market economy, and many policymakers speak of the shift from made *in* China to made *by* China, emphasizing its shifting focus from manufacturing to design and innovation. China is attempting to reduce its dependence on foreign-owned technology by pursuing home-grown innovation and accelerating the transfer of these new innovations directly to industry.

The desired end-result is an emerging China with regions that have world-class industrial base, with the infrastructure, R&D capabilities, educational institutions, and a standard of living that is beginning to match those in the industrialized world.

These changes have caused concern in some quarters of the industrialized world, especially the United States, where the rise of China is seen as an automatic decline of the United States. As a result, many governmental and non-governmental entities are paying special attention to China, its innovation ecosystem, and in particular the science and technology environment.

In two recent studies for the Office of Science and Technology Policy and the National Science Foundation, IDA's Science and Technology Policy Institute (STPI) examined the innovation ecosystem of the United States and compared it with those of current and future competitor nations. Both studies, the first data-driven and the second site-visit driven, resulted in interesting insights about the rapid growth of emerging nations such as China.

Production of Engineers in China and the United States

Leading CEOs across the nation – from Intel Chairman Craig Barrett to Lockheed Martin's former Chairman Norm Augustine – point out that China graduates almost an order of magnitude more engineers than the United States. Others have disaggregated data to differentiate between bachelor's-level and two-year college degrees to show that the

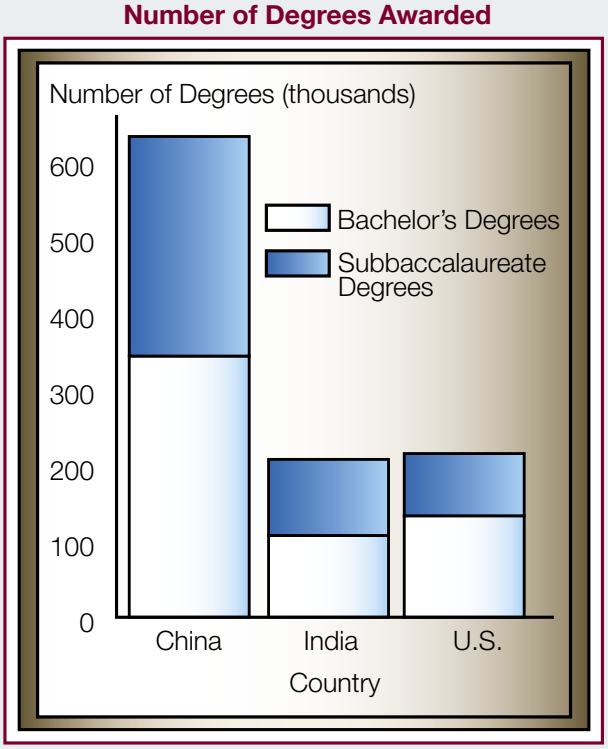

Figure 1. The number of engineering degrees awarded in China versus other countries of interest.

Chinese advantage is less substantial (Figure 1). Despite some disagreements about the production numbers, many stakeholders believe that the United States should produce far more engineers and scientists than it does now in order to sustain America's competitive lead in innovation (taking for granted unproven and implicit links between the number of graduates and competitive performance, without regard to other factors such as the population level, market needs, wage differentials across nations, and other complexities that guide the production of scientists and engineers in the globalized world). Based in part on such data, some members of Congress are asking for more science and technology education funding; in fact, most innovation bills in the 109th and 110th Congresses included provisions to increase the number of science, technology, engineering, and mathematics students in the nation.

While there is general agreement that China produces more engineers than the United States, our study found that there is little discussion of skills and quality of these graduates. Is it possible that most stakeholders are overestimating the quality of the foreign talent pool? Some recent studies propose that only about 10% of the 600,000 engineers graduating in China are of comparable quality to the engineers produced in the United States. So perhaps the real issue is that of skills rather than raw number counts.

The IDA study found little existing data in this area. Much more needs to be done to explore the skills gap (rather than the numbers gap) with China. Would engaging in a numbers race against China work as it did against the Soviet Union during the Cold War years or with Japan in the 1980s? Many experts believe it will not because, unlike Russia or Japan, China and the United States are much more tightly integrated — bound together by the global market structure. All this leads many to conclude that to be competitive in the interdependent market ecosystem, the United States must promote engineering skills that complement rather than compete with China's.

Chinese Students Abroad: Brain Drain or Brain Circulation?

STPI studies of human capital in China also found that "brain drain" to other nations is a major challenge for China. The goal of these studies was to understand trends related to the return of foreign students and post-doctorates to

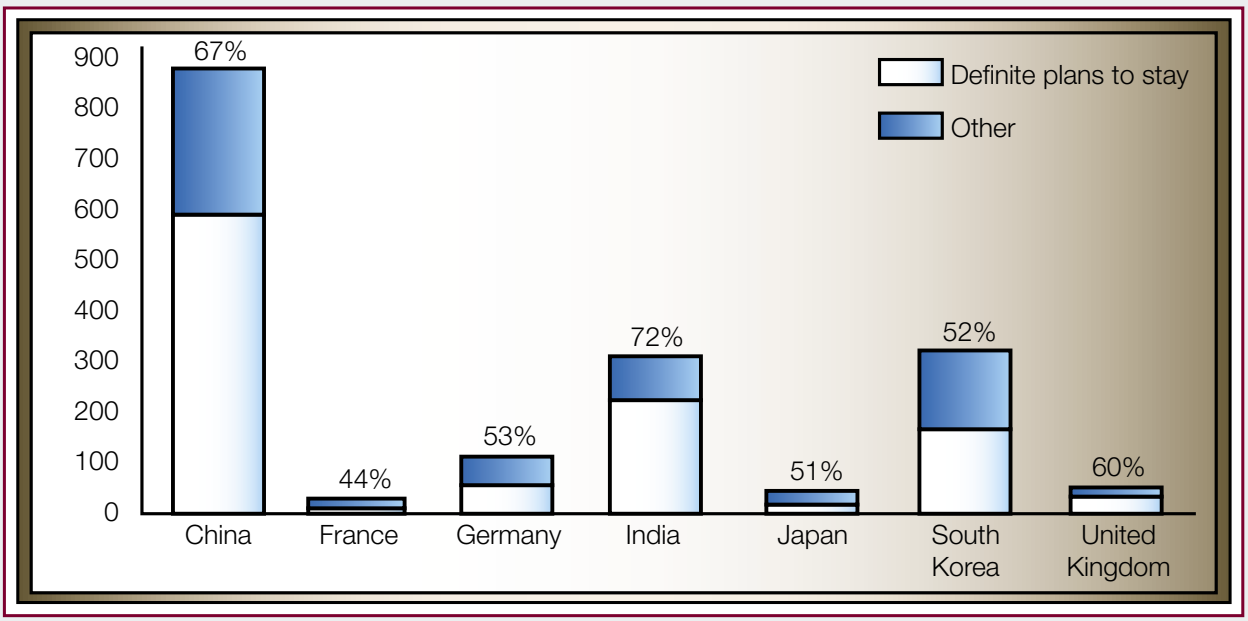

Figure 2. Foreign recipients of math and computer science doctorates from U.S. institutions definite plans to stay in the United States.

their home countries upon completion of studies in the United States (Figure 2). A parallel STPI study indicated that China recognized, and is making efforts to stem, a brain drain problem.

First, some data. In 2004, a total of about 400,000 Chinese students were studying abroad. More than two-thirds of those were in Europe (23%), the United States (23%), and Japan (20%), with the remainder in Australia or New Zealand and other countries (Figure 3). The best Chinese students were attending foreign universities, leaving China's top research institutes such as Tsinghua or Beijing University to compete for remaining talent.

In recent years, through programs such as the Hundred Talents Program, the Chinese government has begun to try to stem this brain drain by attracting talented returnees to China from institutions overseas. Lured by no-interest business loans and tax breaks in 2006, more than 40,000 returnees resettled in China, up from 7,000 in 1999.

During our site visits in China, STPI team members met one such returnee, or "sea-turtle" as returnees are dubbed in China. Professor Jing Cheng at Tsing Hua University completed his doctorate in Europe and received post-doctorate training in the United States before returning to China to establish the National Engineering Research Center for Beijing Biochip Technology (NERCBBT) at Tsinghua University. The Center is renowned both inside and outside of China, with revenues growing annually at 300%.

Eight patents from the NERCBBT were licensed in 2006, enabling it to start a new subsidiary firm - Aviva Biosciences - in the United States, further reinforcing the global linkages created by the NERCBBT. In addition, a small proportion of the start-up funds for Aviva came from Taiwan. The Center also funds activities at the U.S.-based firm Affymetrics for rights to market in China. The Chinese government has made encouraging the success of returnees a priority and has taken steps to make the option more attractive for both young and experienced Chinese entrepreneurs.

Chinese Students Studying Abroad (2004)

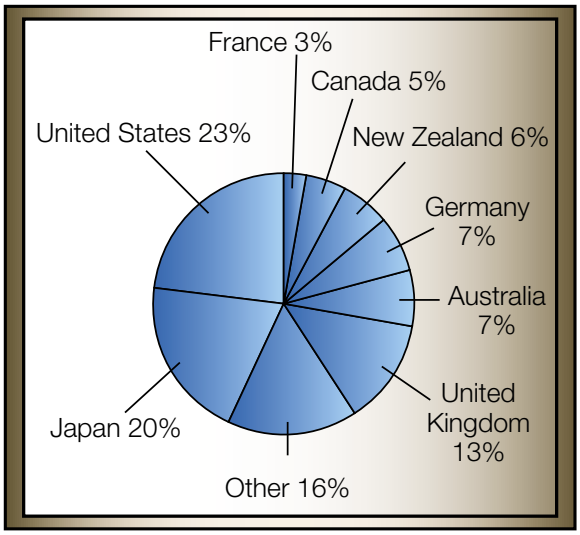

Figure 3. The distribution of Chinese students studying abroad.

The IDA site visit showed that economic growth and the development of China-focused networks of S&T researchers and professionals are as important as government incentives to attract expatriates. As China's wealth grows, research funding and academic infrastructure improve, and the networks within China become increasingly linked to the global scientific community, Chinese research institutions will likely be able to provide greater opportunities for scientists and engineers to conduct cutting-edge research. This in turn may have the effect of encouraging more S&T graduate students to stay in or return to China. The United States would certainly feel the effects: foreign students comprise a significant portion of both science and technology students and the S&T workforce in the United States, and immigrant scientists and many Chinese scientists and engineers have been extremely successful as entrepreneurs.