

# **China's Progress in Technological Competitiveness**

## ***The Need for a New Assessment***

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[http://www.uscc.gov/researchpapers/2005/05\\_04\\_21\\_technological\\_progress.pdf](http://www.uscc.gov/researchpapers/2005/05_04_21_technological_progress.pdf)

### **EXECUTIVE SUMMARY**

This report describes 16 recent remarkable achievements in S&T China has reported in 2005, then proposes 20 indicators that should be used to produce a more accurate future assessment of the rate of progress of Chinese S&T. The report also provides summaries of 6 South Korean alarming assessments of China's dramatic progress in Chinese S&T, in 2005. These Korean assessments, even in summary, seem more useful than the data and trends provided in 1999 by the NSF that were biased toward a slow and backward China, said to be facing daunting challenges with little hope of S&T breakthroughs.

The report does not find fault or address why the various NSF indicators were selected. The actual data is relegated to the appendices. It is more important to ask if the 8 South Korean studies are correct to predict that China will soon be major global S&T competitor. Much appears to depend on which indicators will be selected in a new assessment. That is why 20 new indicators are proposed. (1)

Finally, the report quotes from the 2004-2005 Congressional debate on competitiveness and the NSF and other US science budgets, which have been flat or declining for years. There is little mention of any challenge from China or any other nation. At least we cannot accuse the NSF of inflating the threat from foreign S&T in order to save their own declining budget. Other reports on measures to improve US competitiveness – in taxes, science education, basic research, defense technology–rarely raise any concerns about a challenge from China's S&T competitiveness, with some notable exceptions.

Instead, an old paradigm continues to dominate debate in a way that closes off any policy discussion of what to do about a surprisingly competitive China S&T export economy. This old paradigm seems omnipresent. The Economist magazine mistakenly used it in the current April 9, 2005 issue, claiming falsely: "To assess China's future, it is crucial to understand the countryside...where 800 million live on an average income of less than a dollar a day, rural backwardness weighs heavily on the minds of China's leaders as they dream of joining the ranks of the worlds leading economies." Is it really just a dream? The WTO announced last week that China in 2004 surpassed Japan in exports, and that one third was electronic products. Yet, as long as the press portrays China as just a rural poverty case, its leaders merely dreaming of world economics, it will be necessary for reports like this one to over compensate, by showing a bias of stressing China's remarkable achievements and surprising breakthroughs, ignoring rural poverty and other obstacles.

Predictions a decade ago of slow Chinese S&T progress have now proved to be false. A systematic underestimation has occurred. Improved assessments with new analytical techniques will be needed to avoid errors that the “old paradigm” generated. A 1999 National Science Foundation study scored China very low in future S&T prospects, Yet the same indicators are still in use – patent applications, journal articles cited, numbers of new doctorates, and estimates of percentage of GNP allocated to R&D. These do not capture China’s progress, and have a bias toward underestimating Chinese competitive progress.

In the past few months, China has announced a new supercomputer that operates at 11 trillion calculation per second, breakthroughs in nanotechnology, manufacture of immunochips to detect staph infection, operation of a mini-space satellite, plans to launch another 100 satellites beyond the 70 already launched, a state of the art new pebble-bed nuclear reactor technology, plans to build 40 nuclear reactors [the US has built none since 1970], a Chinese-designed Pentium-style computer chip, a doubling of factory production of robots, design of a new satellite launch vehicle capable of orbiting 25 tons, successful use of cloning cell technology to produce a buffalo, opening of semiconductor design centers, progress by the Institute of High Energy Physics on a electron positron collider, support of a super conducting collider in Germany, partnering with the EU to enable the Galileo global positioning system, and a state of the art planned astronomical observation program . Few if any of these developments would have been forecast a decade ago under the influence of the old paradigm.

Last week, the WTO announced that China has overtaken Japan as the world's third largest exporter, after a 35 percent jump in the country's overseas sales. Surprisingly, electronic goods now account for a third of Chinese exports. Yet Chinese leaders continue to downplay their achievements in S&T, and demand faster progress.

Without a new assessment, US policy makers will likely be further surprised in the decade ahead as China gradually surpasses the US in technology exports. A similar predictive failure occurred in the early 1950s when Soviet S&T progress was underestimated. The Sputnik shock greatly increased US S&T spending. Alarmed by the decline in US technological competitiveness, the American Electronics Association in February 2005 called for “Sputnik Summit” in 2005 to put forth proposals to improve US competitiveness.

This report quotes many recent Congressional statements of concern from Senators such as Bill Frist, Kit Bond, and Barbara Mikulski, and many Congressmen about the federal S&T budget. Consistent with the influence of the old paradigm and the lack of an adequate assessment, the China challenge has not yet been mentioned in these debates. The policy deliberations about China by both Congress and the Executive branch have been disadvantaged by mistaken predictions.

The “old paradigm” of understanding Chinese S&T emphasized China’s backwardness, its overwhelming obstacles, and predicted a slow pace of Chinese progress. This old paradigm was even encouraged by some Chinese official statements, such as the claim it

will take until at least 2049 before China becomes a major power in S&T. The old paradigm promoted a generous, optimistic attitude toward China, even patronizing China's prospects for S&T growth. The old paradigm did not see China ever becoming a worthy competitor with the American superpower, but as a poor, rural nation of 700,000 villages where per capita income was low.

A key part of the old paradigm was the assumption – in spite of Chinese claims – that the Chinese Communist party was headed for a liberal transformation, and that democracy and political liberalization could be expected in a few years. Some who believed in the old paradigm added a twist that some kind of “collapse” in China was likely, but this pathway would also lead to slow growth, and political liberalization. This “collapse” variant seems less likely now.

A new assessment would have to be based on a new paradigm that many are now constructing based on revelations the Chinese have made in the past year of astonishing progress in technological development, combined with extremely firm resistance to any political liberalization.

An up to date assessment of China's recent remarkable progress would aid Congressional deliberations in three areas: whether to adopt a range of proposals to improve US competitiveness, whether to consider measures to restrict China's access to advance technology, and whether earlier predictive errors can be corrected.

The NSF deserves praise for recognizing, as early as 2000, the need to fund studies to improve its indicators and its analysis for measuring national progress in S&T. The NSF assessment in 1999 of China's rank in global competitiveness placed China's prospects below nine other nations including Malaysia, Taiwan, and South Korea using indicators that need to be supplemented in a new assessment.

***Endnote***

1 This subject is explored thoroughly in a 550 page book with 24 expert authors. See *Keeping Abreast of Science and Technology*, W. Bradford Ashton and Richard A. Klavans, editors, Battelle Press, Columbus, Ohio, 1997.