

Losing Our Lead in Innovative R&D

A new Duke and Harvard study shows that research in China and India is getting more sophisticated much faster than the numbers let on

by [Vivek Wadhwa](#)

To hear the National Academy of Sciences tell it, the U.S. faces little risk of losing its technology dominance. In [a new study](#), the NAS says industries such as software, semiconductors, pharmaceuticals, and biotech have adapted well to the opportunities presented by globalization and have kept innovation close to home. After analyzing patent filings, economic data, and prior academic research, NAS researchers report that work being done in India and China is mainly low-level, confined to such tasks as manufacturing and clinical trials. The U.S., the study concludes, will maintain its global lead in research and development if it keeps investing in its research infrastructure. This would be great news for the U.S.—if it presented the full picture.

Our research at Duke and Harvard shows that the reality on the ground is much different. Indian and Chinese companies are performing the most advanced types of R&D for multinational corporations. As a result, scientists from those corporations are rapidly developing the ability to innovate and create their own intellectual property. Our take is that the global technology landscape has changed dramatically over the last decade and that we're at the beginning of a new wave of globalization.

The U.S. can continue to lead, but we need to be clear about our means and the enormity of our challenges. Industries are changing at an unprecedented rate, and we must take the rise of India and China seriously. We also must understand our new competition and work hard to stay ahead—or risk losing dominance in key industries.

Missed Clues

We agree with the NAS that basic supply chains and distributor networks in most industries are becoming fragmented—that they are now more like LEGO blocks. Decades ago, industries tended to be monolithic, with most R&D occurring within national boundaries. Today, in industries such as personal computers, components are designed anywhere in the world, with manufacturing performed mainly in China. American companies such as Microsoft ([MSFT](#)) and Google ([GOOG](#)) still dominate in operating systems and Web applications, but they are increasingly developing important elements of their software in India.

That's where the similarities between the research efforts of the NAS and Duke and Harvard end. The NAS research relied largely on patent and R&D investment data. But in our view, the scientists looked in the wrong places and relied on information that was incomplete or out of date.

Take [their report on the pharmaceuticals industry](#). It analyzed U.S. Patent & Trademark Office filings in 2000. They determined that an insignificant 1.1% of inventors filing pharma patents were based in India, and 0.2% were in China. We believe that to understand what is happening globally, you need to look outside the U.S. So in our recent research into outsourced R&D, released on June 11, [we analyzed patent applications filed with the World International Property Organization](#), based in Switzerland. And we used 2006 data, which showed a fourfold rise in patent filings by Chinese and Indian inventors since 1995. We found that 5.5% of these patent applications listed one or more inventors located in India, and 8.4% listed one or more in China.

But patents only tell part of the story. Patents are a good indicator of R&D, but they don't always translate into innovation. And it usually takes 18 months to five years to get a patent. So these are indicators of research investments made years earlier.

Go, Meet, Ask Questions

Another way to chart R&D, of course, is to follow the money. Yet R&D spending data available through the National Science Foundation and other agencies are very limited; they don't include activities such as product design or technology acquisition, for example. And there are hardly any data on international R&D investment by U.S. and non-U.S. companies. The NAS report noted this and acknowledged the limitations of their analysis, which used these data.

We realized that the best way to learn what was happening globally was to visit the countries growing fastest. Over 18 months we made several trips to India and China and interviewed the executives of approximately 115 companies in the pharmaceutical, semiconductor, automotive, aerospace, cell-phone, and computer-networking industries. We toured their labs, met their researchers, interviewed their customers, and reviewed many of the technologies they had under development.

We found that in aerospace, Indian companies are designing in-flight entertainment systems, collision-control/navigation-control systems, fuel-inverting controls, interiors of luxury jets, and other key components of jetliners for American and European corporations. In the automotive industry, Indian engineers are helping to design bodies, dashboards, and powertrains for Detroit vehicle manufacturers. In telecom and computer networking, Indians are developing futuristic technologies for the intelligent cities that are being constructed in the Middle East. Indian engineers are also developing technology for the next generations of cell phones for European and American companies.

State-of-the-Art R&D

China is already the world's biggest exporter of computers, telecom equipment, and other high-tech electronics. Multinationals and government-backed companies are pouring hundreds of billions of dollars into next-generation plants to turn China into an export power in

semiconductors, passenger cars, and specialty chemicals. In 10 to 15 years, they may also develop their own commercial airplanes.

Most of the R&D in China appears to target the domestic market. India is developing technology for a global market. India appears far ahead, but China is investing massively in building R&D capacity by subsidizing state-of-the-art labs in biochemistry, nanotech materials, computing, and aerospace technologies.

In pharmaceuticals, both India and China are making impressive advances. Our report shows that the largest multinational drugmakers, including Merck ([MRK](#)), Eli Lilly ([LLY](#)), and Johnson & Johnson ([JNJ](#)), first moved manufacturing and clinical-trial work to China and India. And now, driven by cost pressures and growth opportunities, they are partnering with firms there to do sophisticated drug research and clinical testing. Indian and Chinese companies are making strides in the segments of global value chains that are most lucrative. They are also now performing their own drug discovery with the hope of marketing new products through their multinational partners.

We are likely to see new types of innovation coming from India and China. [Dr. Reddy's Laboratories](#), for example, is developing what it calls a poly pill, which combines the four most common medications taken by heart patients—anti-hypertensive, statin, beta-blocker and aspirin—into a single pill. Where's the magic? Satish Reddy, managing director of Dr. Reddy's, says he expects to get it to market for less than \$30 per patient per year in the U.S.

Innovation Where It's Needed Most

[Ranbaxy Laboratories](#) is India's largest drugmaker. CEO Malvinder Singh says his company is focused on finding treatments for neglected diseases endemic to the developing world. These include anti-malarial drugs and pediatric formulations of HIV/AIDS drugs. Similarly, Jason Jin, CEO of ShanghaiBio, says Chinese companies are aiming to cure diseases such as hepatitis B and cancers of the liver and breast, which are common in China.

Is this good for the U.S.? So far, it is. Bob Litan is vice-president of research and policy at the [Ewing Marion Kauffman Foundation](#), which sponsored some of our research. He says: "Having more countries like India and China develop treatments for diseases is good for the world and will help reduce the overall costs of health care."

But will other industries go the way of LCD panels, which originated in the U.S. and moved first to Japan and then Korea and Taiwan? It's too soon to tell. We're not going to be able to stop globalization. Other countries will rise economically and will create inventions that benefit us. This will create new opportunities and competitive risks for the U.S. And it will affect employment. Meanwhile, let's own up to it and [find ways to stay ahead and keep research leadership at home](#) (BusinessWeek.com, 1/18/07)—instead of pretending that everything is O.K. just the way it is.

[Wadhwa](#) is Wertheim Fellow at the Harvard Law School and executive in residence at Duke University. He is a tech entrepreneur who founded two technology companies. His research can be found at [www.globalizationresearch.com](#).